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THE

ART OF WEAVING,

BY HAND AND BY POWER,

WITH AN

INTRODUCTORY ACCOUNT

OF ITS RISE AND PROGRESS IN

ANCIENT AND MODERN TIMES.

FOR THE USE OF

MANUFACTURERS AND OTHERS.

BY CLINTON G. GILROY,

PRACTICAL WEAVER AND MANUFACTURER.

GENERAL SUBJECTS OF THIS WORK.

1. Plain Weaving.
2. Tweeling.
3. Double Cloth, (plain and tweeled,) Marseilles Quilting and Velvets.
4. Cross Weaving, comprising Gauze and Net Work.
5. Figured Weaving.
6. Carpeting; including Ingrain, Imperial, Brussels, Wilton, Turkey and Velvet Pile; also Rugs, Tapestry, etc.
7. Lace and Embroidery.
8. Plain and Figured Weaving by Power.

ILLUSTRATED BY APPROPRIATE ENGRAVINGS.

IN ONE VOLUME.

LONDON:
WILEY & PUTNAM, 6, WATERLOO PLACE.

1845.

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INTRODUCTION.

A THOROUGH knowledge of the Art of Weaving, in all its varieties, is the gradual result of indefatigable exertion, and cannot be acquired, except by a *long* course of practical application in those parts of the world where it is best understood.

Many of our British weavers already possess sufficient skill and dexterity in several branches of this, the most complex of all arts, to prove dangerous rivals to those similarly engaged in other parts of the globe; but the field for improvement is still very extensive. In every quarter of this 'cute country men of scientific genius are busy in applying those elementary and *speculative* principles, which were formerly confined to the closet of the philosopher, to the grand purpose of social improvement. The great chain which connects theory with the useful arts, is rapidly extending, and it is impossible to anticipate what may be the result.

The fabrication of almost every species of cloth appears to have been carried on to a surprising extent in the ancient world; and a knowledge of the processes by which it was accomplished, together with the improvements made on many of them since their introduction into Europe, are objects of the first national importance, and no apology is necessary for our attempting a collection of facts on the subject, embodying them with our own experience as a practical weaver and manufacturer, in England, Ireland, Scotland, France, Belgium, Prussia, &c., for nearly a quarter of a century.

Although the art of weaving the more common fabrics is extensively known in this country, nevertheless, the intricate and ornamental textures are not *well* understood; neither have they been explained by any one thoroughly versed in the business; which precludes the necessity of further observation from us on this head.

A variety of publications relative to this branch of industry, designed for the use of weavers of common fabrics, have, indeed, appeared, at different times, by such authors as O'Doherty, Flanagan,

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have already become ... local. In Great Britain, for example, the Manchester weaver is, in general, as ignorant of the mode of mounting a gauze spider net, as he of Paisley or Glasgow, is of a Pekin brocade, or an Egyptian *shebetz*. The division of labour, however, is carried still further: the mounting of a loom in the figured department is frequently the business of several persons, and the working of it that of from one to six others. Some figured looms have as many as eight Jacquards, of 400, 600, 900, and even 1300 needles each; and from one to four pulley-boxes, each of which has a tail, simple, and drawboy to operate upon it. These complicated looms contain from one to twelve cumber boards (some-

times called *harness boards*) which are often made stationary; but at other times one, or more are elevated or depressed, at every 2d, 3d, 4th, or 6th, passage of the shuttle. In weaving Marseilles quilting and petticoat robes, on this plan, only two shifting harness boards in connection with two, or more leaves of headles, are used. But these subjects will be more fully treated of in another place.

The study of the art of weaving will at least afford to an inquisitive mind, a source of rational and innocent amusement. Besides this consideration, many circumstances concur, to render records of the state of every art, peculiarly desirable. It is well ascertained by the researches of antiquarians and hierologists, that many useful branches of art, which were known and practised by the ancients, have been almost entirely lost, for want of such records. Perhaps two-thirds, or more of them have thus sunk into oblivion; take for example, that of weaving *six* and *seven* ply carpeting, (known to the ancients under the cognomen of *Tymolus matting*,)* by the power of compressed air.

* The eminent German hierologist, Dr. Lepsius, now employed in Egypt by the Prussian government, in a recent letter, after mentioning the many discoveries he had made of ancient ruins, tombs, &c., writes as follows:

"With the exception of about twelve, which belong to a later period, all these tombs were erected contemporaneously with, or soon after, the building of the great pyramid, and consequently their dates throw an invaluable light on the study of human civilization in the most remote period of antiquity.—The *sculptures* in relief are surprisingly numerous, and represent whole figures, some the size of life, and others of various dimensions. The *paintings* are on back grounds of the finest chalk. They are numerous and beautiful beyond conception—*as fresh and perfect as if finished yesterday.* The pictures and sculptures on the walls of the tombs represent, for the most part, scenes in the lives of the deceased persons, whose wealth in cattle, fish boats, servants, &c., is ostentatiously displayed before the eye of the spectator. All this gives an insight into the details of private life among the ancient Egyptians. By the help of these inscriptions I think I could, without difficulty, make a Court Calendar of the reign of King Cheops. But, my friends, let no monument give you or me hopes, since not a pinch of dust is left unturned, by us, of the mortal remains of old King Cheops. In some instances I have traced the graves of father, son, grandson, and even great grandson—all that now remains of the distinguished families, which five thousand years ago, formed the nobility of the land. I now employ daily fifty or sixty men, in digging and other kinds of labour, and a large excavation has been made in front of the great Sphynx."

Another writer has condensed from Rosellini, and other hierologists, the following remarks:

"Philologists, astronomers, chemists, painters, architects, physicians, must return to Egypt to learn the origin of language and writing—of the calendar

Murphy, Ferguson, Peddie, Duncan, Yates and Gog; but, that these writers were wholly, or in a great measure, ignorant of the subject, we have demonstrative proofs in their own works. The books of these men contain merely such scraps and sketches as were furnished for them, by persons who required instruction themselves, as the matter there presented, abundantly testifies. Such compilations are nearly filled with tables and useless repetitions, "*for the purpose of facilitating calculation*," as they are termed. These tables appear rather to have been intended for the use of the plain cloth manufacturer of the twelfth century, than for the fancy warper, or figure weaver of our own day. To the mechanical part of the business, such as the construction of the looms and other apparatus requisite for the production of the more intricate kinds of textures, *and the necessary practical instructions*, they have scarcely alluded in their treatises. They only speak of the art in its imperfect state, as it existed in England, Ireland, and Scotland in times long past; and hence such books are not calculated for the present age of improvement. Indeed, it seems to us, that these authors were, (in the words of Pollok)

> "Resolved (*in spite of fate*) before they died,
> To make some grand discovery, by which
> They should be known to all posterity."

The great majority of mankind are ever prone to limit their desire of information, to that which seems at the time most necessary to their *subsistence*. The weaver who is accustomed to be employed at one kind of work, seldom troubles himself to enquire by what means other kinds are now, or were produced; and although by this constant application to one branch, he increases his practical dexterity in it; yet, such a course, at the same time, tends to impede his progress in the attainment of a complete knowledge of his avocation. Indeed, many of the different species of weaving have already become nearly local. In Great Britain, for example, the Manchester weaver is, in general, as ignorant of the mode of mounting a gauze spider net, as he of Paisley or Glasgow, is of a Pekin brocade, or an Egyptian *shebetz*. The division of labour, however, is carried still further: the mounting of a loom in the figured department is frequently the business of several persons, and the working of it that of from one to six others. Some figured looms have as many as eight Jacquards, of 400, 600, 900, and even 1300 needles each; and from one to four pulley-boxes, each of which has a tail, simple, and drawboy to operate upon it. These complicated looms contain from one to twelve cumber boards (some-

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The ornamental arts are so much regulated by the prevailing fashion, and caprice of mankind, that many species of fancy manufactures lie neglected for years, and, in many instances, they could

and solar motion—of the art of cutting granite with a copper chisel, and of giving elasticity to a copper sword—of making glass with the variegated hues of the rainbow—of moving single blocks of polished syenite, *nine hundred tons in weight*, for any distance by land and water—of building arches round, and pointed with masonic precision, unsurpassed at the present day, and antecedent, by two thousand years before the Dorians are known in history—of fresco painting in imperishable colours—and of practical knowledge of anatomy.

" *Every craftsman* can behold, in Egyptian monuments, the progress of his art four thousand years ago; and whether it be a wheel-wright building a chariot; a leather cutter using the self same form of knife of old as is considered the best form now; the plain, and fancy weavers actively employed at their respective looms; a white smith using that identical form of blow pipe, but lately recognized to be the most efficient; the seal engraver cutting in hieroglyphics such names as Shoofo's, Arphaxad's, and Arkite Ghiden Ghelen's, above four thousand three hundred years ago; or even the poulterer removing the pip from geese; all these and many more evidences of Egyptian priority now require but a glance at the plates of Rosellini."

To this catalogue of Egyptian arts, a long addition might be made of monuments descriptive of the goldsmith's and jeweller's work; instrumental music, singing, dancing, and gymnastic exercises, including children's games, like some of the present day; the tasteful furniture of their houses; ship building; drawings in natural history, so true to life, that the French naturalists, by means of them, instantly recognized the several species of Egyptian birds designated by them; and of numberless other branches of art.

In Persia also, much ethnographic information has lately been brought to light, by the architects and artists attached to the French embassy in that country. Their operations embrace ruins of the ancient cities of Nineveh, Babylon, Ecbatana, Persepolis, Ctesiphon, &c. These researches in connection with the labours of Groteford and Lassen, who have deciphered the arrow-headed inscriptions of those cities, are of great importance in elucidating a portion of the world's history, of which we know so little. The French government has lately sent a party to explore the regions between Cashmere and Kafferistan, with orders to report on the Geography of those countries—the various native tribes by which they are occupied, their languages, monuments, &c.

In Asia Minor a new field for antiquarian researches has been opened, which bids fair to throw much light on the history of several nations, and particularly the Greeks, at a period, the history of which we know but little. The researches of the English have chiefly been in ancient Lycia, where in two different expeditions, Mr. Fellows has made some important discoveries of cities, remains of temples, inscriptions, &c. He has also been able to make out the language of the people who erected these edifices, through bilinqular inscriptions found there. He is now on his way there again, with a large company and a steamer, for the purpose of transporting to England such

never again be introduced, unless a knowledge of the processes employed in their production were preserved. When such knowledge is only transmitted verbally, and when it is confined to operative

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monuments of art as are valuable and in good preservation. The French and Prussian governments have scientific expeditions besides, in other parts of Asia Minor.

In Abyssinia are travellers from England, France, and Germany, who are engaged in scientific explorations of the country. Their labours will contribute greatly to our knowledge of that hitherto unknown region. On the cite of ancient Carthage and in the country adjacent, some interesting discoveries have been made. Among these the following articles have been found:

1st. A complete power loom of *bronze*, of vertical construction, adapted to weave *sixteen* webs of cloth at one and the same operation, either plain, tweeled, or figured, and with from one to thirty-seven shuttles, &c.

2d. A loom for weaving dimity and such stuffs, with tappet wheel to work the treadles, and a curious motion to stop the machine when the weft thread or threads break. This last contrivance consists of two parts, one of which is very like an 'Irish gridiron,' and is fixed in the lay in a vertical position, about three-fourths of an inch from one end of the reed; the other part resembles a French four-pronged eating fork, and is made to play into the former at each, and every throw of the shuttle. But as this motion (with several other valuable contrivances in weaving) was patented by us in England, France, and other countries in the years 1833, 34 and 39, *the claims of the said hierologists to the contrary thereof notwithstanding*, no farther notice need be taken of it here; and particularly so, as it is now being adapted to common power looms at Belfast, Lisburn, Lurgan, and Ballyshannon, where the curious may see it in full operation, and be better able to judge of its merits for themselves.

3d. A spinning machine with two hundred and fifty-six spindles, copper drums, and India rubber bands to drive it; all of which are in a tolerable state of preservation; the whole bearing a very close resemblance to the 'Danforth frame.'

4th. 18¼ yards of 'net work' or lace, figured, similar to that used in the decoration of Solomon's Temple, and of which so frequent mention is made in the book of Exodus. This specimen corresponds in many respects to that shown us by his Holiness, the Pope's antiquarian when at Rome, in April, 1831, and of which we shall have occasion to make further mention hereafter.

5th. 13½ yards of beautiful lace, being composed of gold and silver threads alternately, on which are represented the sun, moon, and stars; the crocodile, pelican, heron, and goose; and also a man and woman in a state of nudity, eating fruit, which they appear to have plucked from off a tree hard by; there is also in the same group a likeness of a serpent, very much resembling our modern boa constrictor.

6th. • A penknife with 98 blades; but this does not so much excite our wonder as the others, because we are well aware of the fact, that immense manufactories of penknives were carried on in ancient Babylon, and other cities of the land of Shinar, long before the Jewish dispensation; see also the 36th chap. of Jeremiah and 23d verse.

tradesmen, employed in the active duties of their avocations, little expectation can be formed of its general diffusion. The attention of such men is naturally more directed to their present, than to their former employments; and when it is no longer in their power to illustrate the instructions which they may, occasionally, wish to convey to others, by showing them the practical operation, the task becomes doubly difficult. From the want of proper information on such subjects a person may possibly think himself the inventor of a certain machine, which he conceives to be legitimately begotten, and may succeed in obtaining, from capitalists, unskilled in the particular art to which it relates, vast sums of money, on the strength of such an impression; and still a similar machine may have been in use long before, or even is at the present day, without his knowledge of the fact. Many a man has been deceived in supposing himself the originator of a certain contrivance, which he might have found described in some old book, or Irishman's portfolio.

It ought to be our study to fix permanently upon the memory, some of the extraordinary events that happened in the world thousands of years before we had an existence upon it. We find ourselves inhabitants of one of the numberless planets which are ever rolling along through infinite space, at a most astonishing rate of speed. We have no means of knowing at present what beings inhabit, or what laws govern those glorious orbs that on all sides surround us, or how far advanced in the arts their inhabitants may have become, and particularly in that of power loom weaving with *mesmeric cams*. We have now no communication with other worlds, nor with the beings that people them. This earth on which we live is ours (that's a fact) and it affords ample scope for human study. The enquiring mind should be anxious to know, who were the best manufacturers of *figured* and other fabrics that from time to time flourished on its variegated surface; what events, changes, and revolutions it has undergone, and how many Jacquard looms, and other useful machines, invented by our antediluvian relations, have been engulphed in its bowels, or otherwise knocked into chaos. It is only by reading, by searching the records of the past, by deep

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We confess that we, ourself, are surprised, that a complete power loom of such astounding capacity (including one of our own patent motions) as that just mentioned, together with a 'Danforth frame,' should be dug up in this way. Such is to us a —— mystery. We will *henceforth* place implicit confidence in the words of the wise man, as recorded in the 1st chapter of Ecclesiastes.

mental application, and above all, by bodily exertion, that we can arrive at this profound knowledge; but, if we can, although only partially obtain some accounts of the arts, and of what has happened connected with them, in ages far remote, it is our duty not to keep them locked up for our own gratification, but to bring them forth for the improvement of our fellow-men, and more particularly for the manufacturing portion of our own community.

We are confident that many, and were about to say, the generality, of readers lose more than half the advantage they might otherwise derive, for want of fixing on their minds the *dates* and *periods* of time most remarkable in the history of such subjects as the present.

> "To him who reads with judging eyes,
> And studies as he should,
> Philosophy brings large supplies;
> His mind improves, his pleasures rise,
> He cannot but be great and wise."

The traveller who visits different countries to view their varied scenery, and, *perhaps*, to pick up the inventions of ingenious men by the way, would experience but little advantage if, when he entered into a zephyr three ply bed quilt manufactory he stood still, and kept his eye fixed on one object only, for example, such as a double or treble shifting cumber board; but when he looks around him, views the electric cams, the mercurial shuttle changers, the revolving detached shuttle boxes, with Poole and Fletcher's patent galvanizers, hollow-cone warp dividers, &c., as they perform their respective functions, both separately and collectively; his eye glistens with gladness and his heart beats with delight, while he sees that he may handily turn the ingenuity of other men to his own purposes, without even thanking them for it. If our traveller should chance to be one of those prodigies of nature, to whom fate has given some lucky powers of combination and adaptation, he at one view can see the mechanism in all its various phases of operation, and he enjoys the scene with exquisite relish.

> "Unto the solid beam the warp is tied,
> While hollow cones the parting threads divide,
> Through which a thousand shuttles swiftly play,
> And for the zephyr weft prepare a ready way."
> (*Metam. VI. O'Roorke's Trans.*)

We shall here notice two objections which have been urged by several English manufacturers against us, in our undertaking to publish the present work.

The first of these is, that it is improper to divulge the secrets of any trade, because it may operate to the prejudice of those who practise it. This doctrine is now so justly, and almost universally exploded, that we shall occupy very little room upon it. It will be seen at once, without entering at all into the question of the policy of monopolies, whether preserved by secret or legal restrictions, that the case does not apply to the business of weaving. It is absurd to suppose that a trade which employs so many millions of people, and which has existed almost since the creation of the world, either is, or can be secret. Besides, experience has sufficiently proved, that liberal and unreserved communication between artificers of all descriptions, has always produced good and never evil. Indeed, it is obvious that every man, where this takes place, receives the advantage of the instruction of many, and gives only his own in return. The balance, therefore, must always be in his favour. With these short remarks we shall dismiss this objection.

The second objection, though it does not appear to us to stand upon a more solid foundation than the other, may require a little more consideration. The objection is, that by communicating information upon the art of weaving, a knowledge of that art may be acquired in other countries, consequently the manufactures may become less productive to those engaged in them.

Although this proposition were admitted in its fullest extent respecting arts in general, it could have no effect on that of weaving, which has been entirely imported from the East, into Europe, and has received but little improvement in this quarter of the globe.

The great antiquity of this art, necessarily involves the earlier ages of its history in considerable obscurity. It is very evident, however, that none of its branches originated in Europe, or America, the cotton stuffs worn by the aborigines of the New World, when discovered by Columbus excepted. According to Melik Cassam Mirza of Tebriz, Persia, the silk manufacture was first practised in China, by Ouang Tippo Ichao,* a native of Tsing Kiang Fou, in the province of Kiang Nau, about the year of the world 1743: and from other sources equally authentic, we learn that the cotton had its origin in India, and the shawl and carpet in Persia.

* The Babylonian shawls, like those of Persia, were adorned both with gold and variously coloured figures. Hence, Publius Syrus compared a peacock's tail, to a figured Babylonian mantle enriched with gold. Their magnificent appearance, and exquisite texture, are celebrated both by the Greek and Roman writers.

These facts sufficiently prove that we have no pretensions to superior knowledge, or exclusive possession of any secrets or mysteries connected with the art of weaving. The very names of many fabrics correspond to the places where they were first manufactured, and the following, for example, are all eastern: Nankeens, Ballasores, Madrasses, Bengals, Lachores, Bungoes, Trebizonds, (a kind of frizzled net) Bagdad lace, Cashmere scarfs, Japan brocades, Pekin brocades, Canton crapes, Turkey gauze, Grecian net, Damask, &c. All these, and many more, including dimity and muslin, are fabrics of eastern manufacture.

Forbes says, "The cotton trade at Baroche is very considerable, and the manufacture of this valuable plant, from the finest muslin to the coarsest sail-cloth, employs thousands of men, women, and children, in the metropolis and adjacent villages. The cotton clearers and spinners, generally reside in the suburbs or poorahs, of Baroche, which are very extensive. The weavers' houses, are mostly near the shade of tamarind and mango trees, under which, at sunrise, they fix their looms, and weave a variety of cotton cloth, with very fine baftas and muslins. Surat is more famous for its coloured chintzes and piece goods. The Baroche muslins are inferior to those of Bengal and Madras, nor do the painted chintzes of Guzerat, equal those of the Coromandel coast." (Forbes, Oriental Memoires, vol. ii. p. 222.)

"In India," says a learned writer, "women of all castes prepare the cotton thread for the weaver, spinning the thread on a piece of wire, or a very thin rod of polished iron with a ball of clay at one end; this they turn round with the left hand, and supply the cotton with the right, (like the ancient inhabitants of Nodville;) the thread is then wound upon a stick or pole, and sold to the merchants or weavers; for the coarser thread the women make use of a wheel very similar to that of the English spinster, though upon a smaller construction. The mother of a family, in some instances, will procure as much as from 7 to 9 shillings a month, by spinning cotton. The tanties or weavers are in six divisions, which have no intercourse with each other, so as to visit or intermarry. They lay the frame of their loom on the ground, and sit with their feet hanging down in a hole cut in the earth.

The coarse cloths worn by the natives are made in almost every village. At the Dhaku factory some years ago, cloths to the value of 80 lacks of rupees were bought by the East India Company in one year; at Shantee-poru the purchases in some years amount to 12 or 15 lacks; at Maldu to nearly the same sum, and at other

places from 6 to 12 lacks. Muslins are there made which sell at 100 rupees a piece. At two places in Bengal, Sonarga and Vicknum-pooru, muslins are made by a few families so exceedingly fine, that four months are required to weave one piece, which sells at from 400 to 500 rupees. When this muslin is laid on the grass, and the dew has fallen upon it, it is no longer discernible. The wool, or rather hair, which grows upon the Bengal sheep is so short and coarse that a warm garment can scarcely be manufactured from it."*

"Of the exquisite degree of perfection," says the eloquent historian of British India, "to which the Hindoos have carried the productions of the loom, it would be idle to offer any description. No modern nation can vie in the delicacy and fineness of its cotton textures with Hindostan. It is observed, at the same time, by intelligent travellers, that this is the only art which the original inhabitants of that country have carried to any considerable degree of perfection. To the skill of the Hindoo in this branch of industry several causes contributed; his climate and soil conspired to furnish him with an abundance of the raw materials, and its manufacture is a sedentary employment, in harmony with the dislike of locomotion generated by the atmospheric temperature. It requires patience, of which he has an inexhaustible fund; it requires little bodily exertion, of which he is always *exceedingly sparing;* and the finer the tissue the more slender the force which he is called upon to apply; the weak and delicate frame of the Hindoo, moreover, is accompanied with an acuteness of external sense, particularly of touch, which is altogether unrivalled, and the flexibility of his fingers is equally remarkable; the hand of the Hindoo, therefore, constitutes an organ adapted to the finest operations of the loom, in a degree which is almost or altogether peculiar to himself."

Bishop Doane, of New Jersey, in a letter to a friend in this city, gives a most interesting account of the remarkable inscriptions found on some ancient monuments near Adon, on the coast of Hadramant (Arabia,) and first deciphered by the Rev. C. Forster, of Great Britain. These records, it is said, restore to the world its earliest written language, and carry us back to the time of Jacob, and within 500 years of the flood.

* A View of the History, &c., of the Hindoos, by William Ward, of Serampore, third edition, 1820, vol. iii. pp. 125—7.

The inscriptions are in three parts. The longest is of ten lines, engraved on a smooth piece of rock forming one side of the terrace at Hisn Ghorab. Then there are three short lines, found on a small detached rock on the summit of the little hill. There are also two lines found near the inscriptions, lower down the terrace. They all relate to one transaction, an incident in Adite history. The tribe of Ad according to Mr. Sale, were descended from Ad the son of Aws or Uz, the son of Aram, the son of Shem, the son of Noah. The event recorded is the route and entire destruction of the sons of Ac, an Arab tribe, by the Aws or tribe of Ad, whom they invaded. In Mr. Forster's book fac similes are given of the inscription; the Aditie and the Hamyaritie alphabet; and a glossary containing every word in them, its derivation, and its explanation; with notes of copious illustration upon every point which they involve. The first inscription of ten lines is thus translated:

We dwelt, living long luxuriously in the zananas of this spacious mansion; our condition exempt from misfortune and adversity. Rolled in through our channel.

The sea, swelling against our castle with angry surge; our fountains flowed with murmuring fall, above

The lofty palms; whose keepers planted dry dates in our valley date-grounds; they sowed the arid rice.

We hunted the young mountain-goats and the young hares, with guns and snares; beguiling we drew forth the fishes.

We walked with slow, proud gait, in needle-worked, many-coloured silk vestments, in whole silks, in grass-green chequered, and damask robes,—woven in the loom.

Over us presided kings, far removed from baseness, and stern chastisers of reprobate and wicked men. They noted down for us according to the doctrine of Heber,

Good judgments, written in books to be kept; and we proclaimed our belief in miracles, in the resurrection, in the return into the nostrils of the breath of life.

Made an inroad robbers, and would do us violence; we rode forth, we and our generous youth, with stiff and sharp-pointed spears; rushing onward.

Proud champions of our families and wives; fighting valiantly upon coursers with long necks, dun-coloured, iron gray, and bright bay.

With our swords still wounding and piercing our adversaries, until charging home, we conquered and crushed this refuse of mankind.

The short inscription in three lines reads thus:

With hostile haste, the men of crime
We assailed; onward rushed
Our horses, and trampled them under foot.

The two line inscription, which is under the long inscription, in the terrace, is as follows:

Divided into parts, and inscribed from right to left, and marked with points, this song of triumph, Sarash Dzerahh.

Transpierced, and hunted down, and covered their faces with blackness, Aws the Beni Ac.

On the subject of these inscriptions, Mr. Forster, in his dedication of his book to the Archbishop of Canterbury, thus remarks:

"What Job (who, living in the opposite quarter of Arabia, amid the sands of the great Northern desert, had no lasting material within reach on which to perpetuate his thoughts,) so earnestly desired, stands here realized." "Oh that my words were now written! Oh that they were printed in a book! That (like the kindred creed of the lost tribe of Ad) they were *graven with an iron pen, and lead, in the rock for ever*. (For mine is a better and brighter revelation than theirs.) For I know that my Redeemer liveth, and that he shall stand at the latter day upon the earth; and though, after my skin, worms destroy this body, yet in the flesh shall I see God: whom I shall see for myself, and mine eyes shall behold, and not another."

But it is not the antiquity of these monuments, however high, which constitutes their value; it is the precious central truths of revealed religion which they record and which they have handed down from the first ages of the post-diluvian world, that raise them above all price. Viewed in this respect, they strike at the very root of scepticism, and leave not even his own hollow ground beneath the feet of the unbeliever. For, if what the infidel vainly would bring into the question, as originating with Christianity, stands here registered as the primeval faith of mankind, there is an end at once, to the idle sophistry of unbelief." "The inscription on the rock of Hism Ghorab, a contemporary witness of the faith of the most ancient of the old Arabians, changes the state of things, placing beyond the cavils of scepticism itself, at once, the fact and the purity of their belief in the scriptural doctrine of the resurrection; and presenting to the eye this great Gospel truth, (to borrow the language of Mr. Burke), covered with the awful hoar of innumerable ages.

"It appears, says his Holiness Pope Alexander VI. that the world was first indebted to one Arkite Ghiden Ghelen, an extremely ingenious artizan of Nodville, for the first regularly manufactured piece of cloth ever produced on the surface of this terrestrial globe; and although it was akin to what we at this day and generation call matting, and produced by twisting and interlacing leaf stems and fibres together; yet the workmanship cannot be surpassed by the best manufacturers of Bolting Cloths of the present day." From this it would appear that his holiness had a sample of the cloth actually in his possession. Perhaps sewing the fig leaves as mentioned in the book of Genesis has reference to the same process.

"An obvious improvement on the garment of leaves, proceeds his Holiness, which was suggested by twisting the peel of rushes into fine strings by which means superior textures were produced (See Fig.

13;) but this improvement was not adopted generally, in the part of the country of which we speak, till after the death of Methuselah.

"It did not escape the notice of the mat weavers, that their work was rendered more flexible and agreeable to the wearer (particularly for under garments,) by the use of a finer fibre, and accordingly we find that numerous trials were actually made, with the fibres of various kinds of plants, such as those of the hemp and flax species."

It is curious how the descendants of our first parents obtained the knowledge of spinning flax into thread. We are credibly informed that it was by *supernatural* agency. We are indeed told by C. G. G., a learned metaphysician of Oxford, that a tradition exists in England, which goes far to prove that spinning was first effectually practised in that country; but we disregard such testimony, as we have found the true and original story, from which C. G. G's. one is evidently copied. This discovery we have made in the collection of Sir Henry Hunlock, and we think it right to give his version, which is as follows.

"There were once an old woman and her daughter who lived at the side of a hill, (not under a hill, as the Oxonian would fain have it) in the midst of a forest, near Nodville. They were very poor, and their only support was obtained from selling the thread which the daughter spun with her spindle and distaff. During the long winter when the roads were so bad that merchants of the surrounding nations could not come to purchase the thread. The daughter, who was one of the most lovely creatures on earth, worked without cessation, in order that she might have enough of thread when the spring market came to enable her to purchase a cloak for her mother and a scarlet shawl for herself, in order that they might be properly attired while attending their devotions. (Where these shawls and cloaks were manufactured is a question for hierologists to solve.)

It so happened that the king of that country, whose name was Zannkul K. Euzen, had an only son, who while out one day deer hunting, went astray in the forest of Akiel, and called at the widow's cottage to enquire the way. He was greatly struck with the girl's beauty and not less with the numerous hanks of yarn which lay upon the floor of the cottage, and equally attested her skill and industry. He asked how it happened that she had collected such an immense pile, and the old woman, whose name was Zabozok, replied that her daughter had spun the whole in a week. "In a week!" exclaimed the astonished prince, "if this be true, I

have found a 'gal' more worthy of my attachment than any other in the whole country. I will send you a load of flax, and if she has it done by the end of a week, I will, *without any other proof of her merit*, choose her as my bride; but if not, I will have you both cut in pieces and thrown to the cormorants and loons, for deceiving the son of your sovereign."

On the very next day a long train of camels, laden with flax, stood before the door of the cottage, and the drivers having unloaded them told the girl that she must spin this quantity in a week, or prepare for death. When they departed her poor heart was crushed with despair. She, however, was unwilling to reproach her mother, even by a look; but she went into the forest, and sitting down under a tree, began bitterly to bewail her sad fate. While she was thus weeping and lamenting, a decrepit old man came up and enquired the cause of her tears, and in reply she told him the whole story. "Do not weep, daughter," he said, "I will execute every one of the tasks imposed upon you by the prince, provided that you will either give me your eldest son, when he is twelve months and a day old, or that you shall in the intervening time find out my name." She agreed at once to the terms. The old man, by some mysterious agency, conveyed away the flax, and about an hour before the time appointed for the prince's arrival, (*which was half past five o'clock in the morning*) returned with the finest and best twisted thread that had ever been seen in Nodville. The prince, according to his promise, married the girl, and conveyed her with her mother to the palace, which stood upon a beautiful rising piece of ground about ¼ of a mile from the city, and overlooking it. (This palace must have been a very magnificent building, as it cost rather more than eleven and a quarter talents of gold.)

Every Monday morning *before sunrise* the prince gave out to his *beloved* the quantity of flax which he expected to be spun during the week, and every Saturday night the yarn was made ready for him by the mysterious old man. At length the princess became the mother of a beautiful boy, and the thoughts of the bargain she had made almost drove her to distraction. Every effort she made to discover the name of the wonderful spinner utterly failed, and he at every visit reminded her that the time was near when he would have the right to claim her child.

One evening as she sat oppressed with melancholy, her husband, who had just returned from hunting, enquired the cause of her sadness, but she was unable to answer him a word. "Come my love,"

said he, "do not be cast down, and I will entertain you with an account of a very surprising incident which occurred to me this very day. I lost my way while pursuing a fine stag which ran towards the great rocks beyond the forest. While searching for his lurking place, I thought I heard a human voice, and following the direction of the sound, came to a cave, where I saw an old man, who did not notice my approach, so deeply was he engaged in a strange sort of labour: he was spinning, not as you do with the distaff, but with wheels which flew round as rapidly as lightning, and gave out thread like water falling from a mountain torrent; and all the while he never ceased singing,

'My mistress, little she knows my name,
Which shan't be forgot, which shan't be forgot,
When a prince as heir to the fortune I claim
Of Wallotty Trot, Wallotty Trot.
I'll come at the end of a year and a day,
And take the young prince, my heir, away.
With my whack! she goes!
While nobody knows;
My trusty machine,
In this cave unseen
Here is the spot
For Wallotty Trot!

The princess made her husband repeat the rhymes several times, until she was sure that she could remember them perfectly, and waited with confidence for the return of the old man. He came at the appointed time, and claimed the child. 'Stop neighbour,' said she, 'there goes another word to that bargain. I have found out your name: It is Wallotty Trot.' 'You have indeed detected my name,' said he, 'and my business on earth is well nigh finished; but before I depart I am bound to tell you the secrets of my art.' So saying, he went into the forest, and in a few seconds returned with his wheels. He then taught the lady their use, showing her that she could spin *sixty-six times* more with them than she could accomplish by means of the distaff; and then vanished; after which he was never again seen in that part of the world.

The prince and princess taught this new branch of industry to their subjects, which so enriched them that all the surrounding nations regarded them with envy and admiration."

These wheels are of similar construction to those introduced into Great Britain by Samuel Crompton, which are known by the appellation of the 'hall-in-the-wood' machine. It is unnecessary for us to give drawings and descriptions of them, Mr. Baines of

Leeds, and Dr. Ure of London, in their histories of the progress of the cotton manufacture in Great Britain, having already done so.

After the death of Methuselah, the art of weaving appears to have made considerable advances in many parts of the East, and particularly in China, India, and Persia. The first loom of which there is any authentic record still in existence, is that invented by Arkite Ghiden Ghelen, when a lad of about seventy years of age; and after having been at great trouble and expense, we have succeeded in procuring a drawing of it, copied from an ancient parchment scroll, found among the curiosities of *Sesac*, founder of the Egyptian dynasty, (who reigned thirty-four years.) But from the dilapidated state of the document, and the draughtsman (Alexis Kersivenus of Alexandria) not being a weaver himself, we fear it is not in every particular like the original. This scroll appears (from indorsements on its back) to have been once in the possession of the emperor of China, Teling Ching Ouang, from whom it descended to Chao Kong-hi-hi, his successor.

Fig A.

is a representation of the loom, &c., which is of vertical construction, and seems to have been chiefly applied to the manufacture of plaids

and cnequers; the patterns of which were most probably suggested by the interlacing of bark or stripes of broad leaved plants. Indeed the modern plaids so obviously represent this origin of their patterns that no one except the most sceptical can for a moment doubt the correctness of this opinion.

The process of weaving in this loom must have been very tedious, and of course the fabrics produced would be expensive in the same proportion. The inventor does not appear to have been acquainted with any instrument analogous to the shuttle, for we find from the perusal of ancient records (imperfect as they certainly are) that some weavers drew the weft through the web with their fingers, and others used an implement somewhat like a knitting needle, but having a hook at one end, similar to the crook of a shepherd's staff, which doubtless insinuated the first idea of that most useful instrument.

The frame work consists merely of two posts, each 4½ inches in diameter, which are indicated in the figure by the letters BB. Between these posts the yarn and cloth rollers are placed. The cloth roller C, may be seen at the bottom, but the yarn roller at the top is not shown in the drawing, although its proper position is evident enough from the manner in which the warp threads DD, descend. Two persons, the one a male and the other a female, are employed during the operation. The former of these is behind the web, in a standing attitude, and is looking as if provoked at having spoiled some part of his work, which, in all probability, the woman in front is adjusting, to pacify the old churl; perhaps, however, he is calling for more weft. These are only suppositions of ours, and the reader must solve the vision for himself, *in all its other phases.*

We almost forgot to mention that young Teague Ghelen, who is playing on the harp, is only 3½ years of age, and seems, although so young, to possess an uncommon share of musical skill. His instrument is one of great tone, being far superior to the Irish harp; and it does not differ materially in its construction from those made by their originator, Tubal cain. In point of symmetry, it is not surpassed even by Tom Moore's No. 1.

We would also add, that the various figures composing the border of this drawing, cannot now be explained, at least until we hear from our friend, Lepsius, to whom we have written for some information respecting them.

We subjoin a few spirited verses, from a well known author, in

compliment to the inventor of this simple, but ingenious weaving apparatus:

> "Great genius of the ancient times!
> A loom like thine was well worth leaving;
> To thee, what are our feeble rhymes?
> First master of the art of weaving!
>
> Between two trees thy web was hung,
> Thy cloth beam nearly touch'd the ground;
> While birds, enchanted, sweetly sung,
> And fruits, delicious, grew around.
>
> Thou breath'd the freest air of heaven,
> The sun, unclouded, gave thee light;
> No lamp, nor gas to thee was given;
> Through day thou work'd, and *slept at night!*"
>
> (*Brien Dhu O' Farrell.*)

We shall now turn to examine some other kinds of weaving machinery, &c., and in doing so our readers may rest assured that our information has been obtained from the most correct sources; but, at the same time, we do not hold ourself responsible for any errors that may have been made by the respectable historian, Deioces, the first king of the Medes, from whom our correspondent (Alexis Kersivenus of Alexandria) copied the specification and drawing which we are about to present. * * * *
* * * * * * * * *

* * * * * * * *

"While," says his Majesty, "engaged with state affairs, on the ninth day of the month Adar, in our royal palace at Ecbatana, * * * * * * * dog from the land of Shinar, who called himself *Arphaxad*, came unto us begging the loan of our royal ears, while he would describe the nature of a wonderful engine of his invention, and which the said alien pronounced in our hearing to be a creature of surprising capacity, and likely to add to the welfare of our beloved subjects. We, being at all times disposed to facilitate as much as in us lies, so desirable an object, of our grace and clemency did lend unto the said infidel the use of our royal ears, thereby enabling him to approach within nine cubits and a span of our most high Majesty to explain more clearly to our *perfect* understanding the peculiarities of the animal.

While the barbarian was about to proceed with a description of his mechanical monster, we issued our mighty mandate, calling upon our trusty scribe and penman, Deog, to appear before us, and to copy down *verbatim* the whole of the Oration, as delivered with fear and trembling in our royal presence, by the said heathen, whom at the same time we commanded to speak slow, that no errors of judgment might be made. We here give in our most excellent History, for the good of our well beloved subjects, the words as recorded.

O most noble Deioces! Great monarch of the Medes, whose laws change not! Much to be dreaded! May it please the King's most excellent majesty, I, an humble descendent of our great father Noah, have invented, arranged, and worked, after having experienced sixty-five years of sore toil and anxiety of mind in this vale of tears, a weaving engine to be driven by the power of compressed air, and which, O King, I now beg leave to explain.

May it please your Majesty,

My invention, with all its combinations, parts and appurtenances, is applicable, either separately, or conjointly, as the nature of the case may be, to the manufacture of *all sorts* of cloth, whether plain, tweeled, or figured. The arrangement which I propose to employ, consists in improvements on a weaving apparatus, invented in the days of Haran, the father of our unfortunate brother Lot, who once lived in Ur of the Chaldees, * * * * *, and which loom or contrivance bore the title of 'Ghelen's vertical mat loom.' But it is unnecessary to enter into a description of it, as the looms constructed according to the present improvements have such *different* properties from the said Ghelen's, as to have very little in common therewith, excepting in the circumstance of the cloth, during its formation, extending in a vertical plane.

The main object of the present improvements is to enable me to weave four, or more webs at one operation; and yet my machine contains but one lay, with suitable contrivances for moving it, alternately, upwards and downwards.

And may it please the King,

Figure B, represents a vertical section of the creature, taken transversely through the lay, A, which is placed in a horizontal position, with two reeds B B, in it, one extending across the loom at the front, and the other at the back. Each of these reeds is adapted to weave two, or more pieces of cloth, from one of the warps, C C, each of which warps, by means of a division in the centre of its reed, and an extraordinary arrangement of the headles, is divided into

two, or more distinct sheds, through which shuttles are to be thrown, leaving a weft thread, or threads (as the case may be) in each of the sheds.

And, may it please the King,

The warps of these webs, are to be wound upon two rollers D D, placed at the bottom of the loom, and parallel to each other: the threads which proceed from them, are conducted upwards through the headles, which are extended horizontally, then into the reeds B B. The threads so proceeding from each warp roller, are now divided into two, or more series, for weaving distinct pieces of cloth; and for this purpose, the surface of the dents of each reed, is divided by means of a long narrow ruler, (which is secured across the dents) extending the entire length of the reed, so that the surface which the dents present, is divided into two, or more parallel shuttle races. There are in all four, or more of these races, for the passage of as many shuttles, which are to be thrown (with great precision) by a simultaneous motion, through the several sheds open for their reception. The warp threads, as they come from their respective rollers, are conducted up through these shuttle races. The headles E E, are tied across the loom from front to back, beneath the reeds, and every headle has two, or more eyes in it, at suitable distances apart, to receive as many threads of warp, one of them belonging to the front warp roller and front reed, and the other to the back set. Each headle operates upon two, or more of the webs, which are to be woven at once; and by working them, all the warps will be divided, and opened into sheds, at the same instant. The lay, with its reeds, remains stationary, at its lowest descending point, while the shuttles are passing through the sheds; but, immediately after they have made their exit, it begins to ascend, carrying up with it the weft threads. The sheds are all closed by a suitable action of the headles, while the lay is ascending, and when it reaches its highest position, the reeds knock up all the weft threads between the closed warp.

And, may it please the King,

The fabric as it is woven is drawn upwards, and wound round the cloth rollers F F, one at the back, and the other at the front of the loom, and corresponding to the warp rollers. The accessaries, and new improvements which are proposed to be applied to vertical air-looms, according to my invention, for the purpose of weaving four, or more webs at once, in the same machine, are as follows.

1st. In order to avoid stopping the motion of the loom when one or more of the weft threads break, or become exhausted, a few spare

shuttles are to be lodged in suitable receptacles, which are so arranged, that the mere breaking of a weft thread, will cause a change of shuttle instantaneously, (by the substitution of a spare one in its stead.) The method by which I accomplish the operation is this:

On a weft thread breaking or becoming exhausted, the corresponding shuttle will be jerked out of the lay, into a sluice, made through the back side of the machine, and from thence conducted to the 'catcher,' at the lower end of the weaving room, or at some other convenient place, (as the case may be) where it is refitted with a new cop or quill, put into what is generally designated 'Nahor's air fly,' in which is a cylinder containing a moderate quantity of compressed air. On the shuttle being entered at the top of the fly, (exactly in the same way that bullets are dropped into 'Perkin's steam gun') it descends into the return conductor, where the end of a rod, not unlike the suction-rod of one of your Majesty's garden pumps, is brought to bear against it; but, that the point of the shuttle may not be injured by the sudden action of the propeller, the latter is hollowed out to fit the end of the shuttle, to about two-thirds of the nib's length, and the shoulder thus formed will prevent any little mishap of that nature, which might otherwise occur. The shuttle being thus made ready, the cop tender (bobbin winder) tips the 'let off,' whereupon that shuttle speeds its way to replace some one of its fellows, that has become exhausted, and thus a uniform system of operation is constantly kept up.

And, may it please the King,

That if by neglect of the cop tender, the receptacles be not provided with spare shuttles, nevertheless the loom will stop of its own accord: the arrangement by which this is effected is as follows:

The shuttle, Fig. C, is provided with a spring dent 1, the end of which, nearest the cop 2, is made heavier than the other, and is kept raised by the tension of the weft thread, when unbroken; which thread passes over the pin 3, through an opening (or eye) at the end of the detent, and over the studs 4 and 5, then through a hole at the lightest end, passing under the pin 6, and out at the eye 7. Thus, on the breaking or failure of the weft thread, the weightier end of the detent, being no longer upheld, will lie on the bottom of the shuttle elevating the other end, which on entering the box or cell, forces back a projection that protrudes through an opening in the picker; and this projection on being forced back,

acts upon a series of levers, which cause the cells containing this shuttle and its fellows, to move towards the right hand side of the loom, their places being filled by the two adjoining cells, containing spare shuttles. This operation is repeated on the breaking, or failure, of a weft thread, as many times, as there are pairs of spare shuttles provided (say *eleven* times ;) but, if by the neglect of the tender, in not replenishing the cells with spare shuttles, (as I before stated,) the whole number has been exhausted, and another change is yet required, then, the safety regulator will, by means of a lever, draw out the connecting pins from the lay arms, on the main driving shaft, which pins keep this shaft attached to the working parts of the loom, and as soon as this is accomplished motion will be suspended.

2d. And, may it please the King,

The arrangement of the headles or what is called the mounting of the loom, is so contrived as to be suitable for weaving four, or more webs of plain cloth at once ; but it admits of introducing a greater number of headles, than the two which are requisite for plain weaving ; and, in fact, the mechanism by which they are worked (*with a slight variation*) admits of weaving any kind of tweeled cloth, by means of *any* convenient number of headles.

3d. And may it please the King,

The loom is also provided with substitutes for temples, for the purpose of keeping the webs of cloth properly extended, during the operation of weaving : they are a sort of pincers JJ, of which there are four, or more pairs, two, or more, at each side of the loom. After the shuttles are thrown, while the sheds of the warp are closing, and the lay is moving up towards the cloth, the jaws of all the pincers are closed by the wedge-like piece H, attached to the rod I, which moves the lay up and down. This piece H causes the two rollers shown by the dots, to recede from each other, and to close the pincers upon the selvages. The moment the picks of weft are knocked up by the reeds, the lay descends, the pincers advance towards each other, and their jaws are again opened, ready to grasp their several selvages as before.

4th. And, may it please the King,

The warp rollers DD, are loaded with only small retaining weights, (applied as in said Ghelen's loom) in order that the friction thereby produced may occasion but a slight resistance to the rotation of the rollers, as the warp is drawn off by the gradual formation of the cloth. A ratchet wheel is fixed upon one end of each warp roller, and two clicks are so connected with the machinery,

which carries the lay up and down, that as it is rising to knock up the weft, and while the sheds are closing, each of the clicks will be brought into the teeth of the ratchets, and will turn the warp roller round as much as is necessary to wind it back to a suitable tension; but as the lay descends again, and the warp requires to be opened into sheds, the said clicks are withdrawn by the machinery, from the teeth of the ratchet wheels, leaving them at liberty to yield and give off more warp. Each of the cloth rollers gathers up two or more pieces at once, and consequently it will increase in size faster than said Ghelen's loom, which winds up only one thickness. The mechanism for turning the cloth roller round adapts itself to this circumstance, so as to take up the cloth at the same rate when the rollers have become larger, by the accumulation of cloth around them, as when they were smaller. This is effected by the following means:

They are turned by the screws or worms M M, taking into the teeth of the wheels O O: the screws or worms receive their motion from a ratchet wheel N, affixed on the same axis: this ratchet wheel is turned by four clicks, or drivers, attached to a lever, having an ascending and descending motion. This motion is regulated by a rest that rises from a rod, which is parallel with the roller, and bears upon the cloth wound upon it, so that as the roller increases in diameter, the rest, being raised, will limit the descent of the lever above mentioned, and thus the cloth rollers will be turned with a continually diminished speed.

5th. And, may it please the King,

By means of other mechanism for changing shuttles, the webs may have cross stripes, of different colours of weft yarns, or of different strength and appearance. For this purpose the several sets of spare shuttles being charged with different kinds of weft, will occasion like changes in the web, so as to produce cross stripes, which may, also, be combined with longitudinal stripes of various colours, or strength of warp thread, or threads (as the case may be) suitably arranged in the previous operation of warping; so that by combining cross and longitudinal stripes, chequered patterns may be produced, which in many respects *differ* from those made in Ghelen's machine. The shuttle boxes, or receptacles for the reveral shuttles, which contain weft of different colours, have as many cells, situated one over another, as are required for the reception of the several sets of shuttles; and they are raised or lowered by means of a series of levers, suspended on the axis P, at the top of the loom, the boxes being hung, one from each end of a lever. These levers re-

ceives their motion from another series which are operated upon by a revolving barrel, placed above the cloth rollers, (but not shown in the drawing.) This mechanism raises or lowers the boxes, just as much as is necessary, in order to bring the particular set of shuttles wanted, to a proper level for being propelled through the several sheds.

6th And, may it please the King

The above described mechanism can be readily altered, so as to operate with different orders of succession, thereby producing a great variety of patterns; and also, with a new plan of mounting the headles, adapted for figure weaving, combined with new figuring machinery, the four, or more webs, which are to be woven at once, may have ornamental patterns upon them of the nature of what is termed 'fancy weaving.' Or, in lieu of the said figure weaving machinery, I apply a peculiar combination of suitable parts, which receives the diversification of its action, from a pattern board X, which is shown on a large scale, at Fig. D. Upon the flat surface of this board the design is carved in *relief*, the parts which are to exhibit the sundry colours being cut down to different corresponding depths. The pattern-board is now placed in its situation at the upper part of the loom, as shown at X, its carved surface being presented beneath the under extremities of a row of needles or small slides S, which stand side by side in vertical positions. These needles, severally, (at certain intervals of time) during the operation of the loom, are let fall upon the said carved surface, and by the inequalities of the relief, some of them are allowed to drop lower than others. Those which are sustained by the more prominent parts of the carving, are acted upon by a straight edge or rule T, placed horizontally across all the rows; which straight edge, being taken backward when required to act, comes in contact with certain lateral prominences in the needles, so as to push back all those which are prevented from falling, by carving on the pattern-board. Each needle is connected with, or tied to a lever U, which levers are placed transversely over the loom, their back ends bearing upon a fulcrum. One, or more of the headles are suspended from each of these levers, near to the middle of its length; and all the levers being thus placed side by side in a row, at the top of the loom, their front ends form a row across the loom, until some are drawn back with an endway motion upon their fulcrum, by the straight edge, T, acting upon their corresponding needles.

The front extremities of those levers which are not drawn back, are lifted up by the edge of a horizontal lifting bar W, which rises

upwards, when the sheds of warp are being opened; and in rising they pull up those headles which are connected to them, by which means a proper selection of warp threads, to form the pattern, is effected.

By the different depths of carving on the pattern-board X, the needles are thus divided into several series, which are acted upon successively, by the straight edge T, in order to produce a change in the selection of warp threads. The pattern-board is fastened upon a moveable table R, which is shifted either backwards, or forwards (in a slow progressive manner,) by the pinion Y, taking into the rack Z, attached to the under part of the table. This pinion receives its motion from two ratchet wheels fastened on the same axis, and these wheels are turned by drivers.

7th. And, may it please the King,

Each time the pattern-board moves, the needles are raised and let fall again, so as to come on a different part of the pattern, by which means another selection is effected. As soon as the pattern board has been conducted along its whole range, and the figure transferred to the cloth, all the needles are lifted up; whereupon the board returns to its first position, with an instantaneous movement. Should the board have only half the pattern intended to be woven, carved upon it, as soon as that is worked up to its last line or change then, the action is reversed, bringing the needles on the second line of the board, which is now worked backward, with the same speed that it went forward, and thus the other half is produced. Patterns consisting of two similar halves, need only half the carving of those described in a former instance.

And, may it please the King,

Instead of the above, the pattern may be carved on the circumference of a cylinder, which is in all respects the same as those formerly constructed by our relation, Jubal, the organ builder, (see also Genesis, iv. 21.) mounted on a horizontal axis, and turned round with a slow progressive motion. If the pattern is exactly the size of the cylinder, as soon as the latter has been once passed under the needles, it will return to its first position; but, if only half the pattern covers it, (the other half being a repetition of the first) then, as soon as it has made one revolution, it returns in an opposite direction, and so on, alternately.

To produce a variation in the succession of the changes of the shuttles, a portion of the carved surface of the pattern-board, or else a *distinct* pattern-board, must be provided, and carved with alternate elevations and depressions, for lifting their several elbow

levers, and the levers below, which are connected with stop detents, for detaining them, and determining their positions. The revolving barrel, before mentioned, may also be applied for effecting the raising or lowering of the shuttle boxes, in a *proper manner* to change the shuttles, and produce cross stripes; as the position into which the revolving barrel, is turned and detained, previous to every succeeding pick of weft, determines which of the different colours of weft, shall be thrown.

And, may it please the King,

The mechanism of the figure weaving loom will be simpler, if the plain or tweeled ground of the cloth is produced by a distinct apparatus. To effect this, those headles which belong to the yarns that are to form the warp of the plain ground, are united to a few *lams* (thin shafts of wood or iron) so that by drawing up one of these a number of headles may be raised together with one motion. The lams are to be suspended from horizontal levers at the top of the loom, in a similar manner to the levers U, and disposed in the same row.

It was before stated that only one or two headles were suspended from each lever; but, by means of the lams, several may be suspended from each of them. These are provided with needles similar to the others, and which *might* be actuated by being dropped upon a suitable part of the surface of the pattern board; but, as this would only produce a repetition of a simple series of changes, *I prefer to substitute instead, a small cylinder or revolving barrel*, the surface of which is carved into a series of suitable prominences and depressions in order to actuate the needles, in a similar manner to the pattern cylinder before described.

And, may it please the King,

Whereas, cylindrical barrels, studded with projecting pins, similar to the organ barrels of said Jubal, have been used in different parts of your most gracious Majesty's dominions, for *other purposes than that to which I propose to apply them*, I, therefore, make no claim to the invention of such barrels, *except* when the same are applied to my figure weaving machinery, of the kind before described, with needles and other necessary parts, for weaving four or more webs at once, in the same vertical power looms; and also when the surface of said barrels are carved with different heights and depths, at all parts which are to be represented on the cloth with difference of colouring. I would *remark also* that when small patterns are to be produced upon the cloth, I use, *instead* of the said machinery, (for working any reasonable number of leaves of headles) a contri-

vance or invention, which I call a *tappet* wheel, formed of a suitable number of segment pieces of iron or smooth stone, in the faces of which segment pieces, indented grooves are made or cast, for the purpose, when combined, of producing a zigzag groove round the face of the wheel, to suit any required pattern to be woven in the cloth. In this zigzag groove a roller works, attached to an upright rod, which is connected to the levers or treadles; and, hence, as the tappet wheel revolves, the treadles are worked up and down, according to the elevations and depressions formed in the wheel, and the requisite portions of the warp are raised and depressed to form the sheds.

The segment pieces are all made to correspond and to fit together in the wheel, so that they may be readily changed, and a different zigzag groove produced when required, according to the sort of cloth to be woven, thereby superseding the necessity of casting or making many wheels, having different shaped grooves, and of shifting them where any variation in the weaving is wanted. The rod which holds the roller that works in the tappet, is connected above to the two outer jacks, as in the ordinary power loom, and acts upon vertical rack bars that take into a pinion, which raises and depresses the portions of the warp equally, and thereby prevents any *under strain*. There are certain vibrating bars connected with the jacks and with the needles, which are thrown from side to side by the action of the tappet rod on the racks and pinions; and these bars have notches in their edges, which are taken hold of by horizontal bars connected to the treadles, for the purpose of moving or holding back certain of the needles, agreeably to the command of the tappet wheel. The rising of the tappet rod, and the rack bar, works a crank that slides the pattern board, and brings the successive lines of the pattern under the ends of the levers or needles; and a spring is introduced to ease the action of the pattern frame.

And, may it please the King,

I also claim the *honour* of inventing a new arrangement of mechanism, *which has no connection whatever with any part of my machinery already described*, but yet is so *essential* to the general well-being thereof, that I cannot resist the temptation of explaining it *separately*, and claiming it in combination with the former (notwithstanding the claims of the said Ghelen.)

The leading feature of this improvement consists in the peculiar arrangement and order of working certain parts of looms in general, so that a new description of cloth shall be produced or woven; and it is more particularly adapted to that class of silk fabrics called

'Kiang Nau'* satin; the ordinary quality of which has one face highly finished and glossy, owing to the brilliancy of the warp threads being thrown up on one side or surface, while the reverse or *back side* of the cloth presents a dull unsightly appearance, owing to the absence of the warp threads to the vision. Now, by the aid of my improvements, in the arrangement and order of working the loom, and by introducing a double set of warp threads, I am enabled to produce a very *extraordinary* description of goods, both in point of texture and quality; the great novelty of which consists in its having a perfect or distinct finished surface on each side of the fabric; and I am enabled also to present, two entirely different colours of cloth, one upon each side or surface of the piece, without the slightest variation in finish, brilliancy or appearance otherwise, but being, as it were, a double cloth, having two perfect sides or surfaces, and bound or held together, by threads of weft at *certain intervals*. The manner in which such manufacture is to be effected is *entirely* dependant upon the peculiar order, or succession of working the treadles, so as to divide or 'shed' the two, or more coloured warps in such a manner that a certain number of threads shall always be 'floating' to cover the weft on each side, and also a proper number of threads, only, shall rise and fall at certain intervals, to bind the picks. All this I accomplish with the aid of the tappets, as already *recorded*, the treadles being worked by them in order to open the proper sheds.

The warp threads are to be prepared and wound upon a beam as usual; but in case the cloth is required to have two distinct colours, (that, is, one upon each side or surface) *then, the warps must, of course, be of the colours of the intended satin.* I would also remark, that the satin or glossy face may be produced, by the weft instead of the warp; and this may be effected, simply, by lifting *one* headle out of every eight, for the upper cloth, to each pick of the weft; by which means $\frac{7}{8}$ths of the weft, will show on the face, instead of $\frac{7}{8}$ths of the warp, as in the former plan. The under cloth satin face, may be produced by arranging the tappets so as to lift $\frac{7}{8}$ths of the warp, leaving $\frac{1}{8}$th part down, and thus $\frac{7}{8}$ths of the weft will be thrown on the under side, as it was above in the upper cloth.

And, may it please the King,

Having now described the nature of my inventions, or improvements in looms worked by the power of air, or any other agent of

* *Kiang Nau*, the name of a Chinese province.

nature, which may be hereafter found out, procured, or otherwise brought into existence, for the purpose already described, viz., of weaving four, or any other number of webs of cloth at once, in the same engine or verticle power loom, or looms, by simultaneous action of the various parts, combinations, and appurtenances thereof, in the manner, O King ! before described and set forth ;

1st. I desire your Majesty to understand that I do not claim as my invention or inventions, improvement or improvements, combination, or combinations, the whole of said machinery ; as many parts thereof are of the said Ghelen's invention, and in *common use ;* but what I more particularly mean to confine myself to, and that which I wish to be *considered* the honourable inventor of, while I live in this world, is, first,

The reeds BB, for knocking, or pounding up the weft, or wefts of four, or any other number of webs ; such reeds being contained in the same moving frame or lay, or otherwise affixed as the nature of the case may require, and each of them being divided into two, or more separate shuttle races (for weaving half the number of webs,) and the headles dividing the warps, being adapted for opening the same into four, or more sheds.

2d. And, may it please the King,

I claim as my invention, the mechanism described for changing the shuttles, in a vertical air loom, for weaving four, or any other number of webs at once. When any one, or more weft thread, or threads break, or fail, the said mechanism then substitutes a spare shuttle, or shuttles by an instantaneous movement, without any act of the attendant, and without stopping the loom. I also claim the *peculiar* method before described, of forcing or pitching the shuttles, as fast as the weft thread, or threads break, or become exhausted, into a sluice, or conductor, cut through the back side of the machine, in the manner and for the purpose set forth. And, moreover, whereas, various contrivances have been before applied in shuttles, so as to cause the loom to cease operation, when the weft thread breaks or fails, I make no claim to the invention of a motion in the shuttle, for the purpose of causing the loom to stop, but only to the mechanism which changes the shuttles for others containing weft thread, or threads, and that too without stopping the loom.

If by any untoward circumstance, the loom should not stop when required, notwithstanding all these precautionary measures, the linch pins or keys, (as before described) are drawn from the arms which connect the lay to the main driving shaft of the machine ;

when this is accomplished, motion *will be effectually suspended.* All these arrangements I claim to be of my invention.

3d. And, may it please the King,

I claim the improvement, before described, of applying and combining, or otherwise arranging four, or any other number of moveable pincers or crabs, for extending, widening or stretching (in breadth) the cloth of four, or more webs, which are to be woven at once, in a vertical, *or any other kind of loom*, the said Ghelen's vertical mat loom excepted.

And, whereas, a kind of pincers, or crabs have been applied to ordinary looms, (which weave one piece of cloth at a time) for the purpose of holding such cloth, in their claws, jaws, or gums, (as the case may be) to the same width at which the reed leaves it, after having beaten in the weft, such *nippers* having been invented by Lemuel P. Arybas (a sojourner in the Cities of the Plain) I make no claim to them; but only to the application of my apparatus to vertical looms, propelled by the power of air, or any other agent, for weaving four, or more webs at once; *nor do I mean to confine myself to these particulars*, but will be governed by the nature of the work to be produced.

4th. And, may it please the King,

I claim the improvement, before described, of mechanism for changing the shuttle boxes, from one side of the loom to the other, when all the weft in such shuttles as are contained in a receptacle, has become exhausted; and also that of replacing such receptacles, charged with another carriage full of shuttles, containing cops or quills of different colours, or appearances, as the nature of the case may require, for the purpose of producing cross stripes, or chequered patterns of *every possible* description; and also, for effecting *all* changes of colouring, or appearance as are required in figure, or ornamental weaving.

5th. And, may it please the King,

I claim the improvement, before described, of the mode of mounting the headles, suitably for figure weaving, in a vertical power loom, by which four, or more figured webs of cloth may be woven at one and the same operation; and, lastly, O King! I claim the improvement, or combination of mechanism, before described, for drawing up the headles, suitably for weaving figured patterns, in a vertical power loom, on a surprising number of webs at once; which mechanism derives the diversification of its successive actions on the headles, from a carved pattern board, or from carving on the circumference of a revolving cylinder, that carving being a repre-

sentation of the required pattern, in relief, with different stages in the heights and depths thereof, at all the parts which are to be woven with different colours, or with other variations in appearance, as may be derived from changing the kinds of weft which are employed; and I also claim, as of my invention, the tappet wheel contrivance or apparatus, before described, for working any *reasonable* number of leaves of headles, the claims of the said Ghelen, and of the said Arybas, to the contrary notwithstanding.

And, may it please the King,

I also claim the *honour* of inventing the improvement in looms for weaving in the same piece of cloth, two, or more pieces of *imitation Kiang Nau satin*, or fabric having two equally perfect and finished sides or surfaces, either of similar or distinct colours, qualities, or materials (as the case may be) the claims of the said Ghelen to the contrary thereof notwithstanding.

After hearing the Oration of the said Arphaxad, we ordered him to be rewarded with an annual pension of forty-five shekels of gold, in lawful money of these realms, during the natural period of his existence in this world; and we commanded a short Document to be drawn out by our scribe, to be regularly signed by the inventor before witnesses (he being a barbarian) and to be affixed to the description of the monster, as copied word for word by Deog. We condescend to add in our History this document, which is as follows:

All these arrangements, improvements, and combinations of mechanism, I claim as of my invention, the claims of the said Arkite Ghiden Ghelen, or of the said Lemuel P. Arybas to the contrary notwithstanding; in testimony whereof I hereunto, on this tenth day of the month Adar, set my hand and seal,

E. K. ARPHAXAD.

Witnesses { Ziff Deog, R. S.
Erbil Hazer, J. P.

We have received the following letter from our friend at Alexandria (Egypt,) who furnished us with the foregoing specification and drawing, in answer to one we wrote to that polite gentleman on the 22d January last, and in which we made various enquiries respecting the several human figures, &c., represented in the draw-

ing with Arphaxad's machine, but of which the historian (we regret to say) gives no account. Mr. Kersivenus, being well versed in such matters, explains nearly all these important omissions, in the present letter.

Alexandria, April 23d, 1843.

Dear friend,

I received your favour this morning, bearing date 22d. January last, the contents of which I duly note. In the first place, I am happy to hear of the safe arrival at Belfast, of the drawing of Arphaxad's loom, which I had the pleasure of sending you on the 11th August, 1842, and the procurement of which gave me no small trouble, besides, the immense expense levied by his Highness before I was permitted to copy from the original scroll. But, now that you have received the drawing, which is faithful in every particular, I entertain no fears of your success, well knowing that such an enlightened people as the sprightly natives of the Emerald Isle, have the proper spirit to appreciate your exertions to benefit them in their manufactures, by the introduction of this most useful engine amongst them. However, this is no business of mine; and my object at present is to answer your letter.

You enquire the reason why I did not (in my letter of 11th August, 1842,) give you an explanation of the various human figures represented in the drawing along with the machine. Why, my dear friend, the truth is, I forgot to do so; and I now beg pardon for having been guilty of so great an omission.

In answer to your first enquiry as to what the figure No. 1 is, and for what purpose, he is perched upon the top of the loom, I would state, that it is not a human being, as one might at first sight suppose, but only a part of the mechanism called the '*alarm loon*,' for the purpose of giving notice to the weavers, when a weft or warp thread breaks, in case the other motions fail to perform their respective functions, as described by the inventor before king Deioces. The manner in which the loon operates is as follows :—

There is an air cistern, or cylinder, placed transversely at the back of the different warps, having 3796 holes of ¼ inch in diameter pierced in it; to each one of which holes, a small tube is soldered of sufficient length to reach up to the under extremity of the figure No. 1, passing into that part of the machine on which it is seated, and from thence into his interior. This arrangement being clearly understood, the operation will be obvious after a little ex-

planation. There is a small valve or air latch on the side of each of these tubes or air conductors, just about 2¼ inches from the cylinder. To each of these latches, the end of a small cord or wire chain is made fast, the other end having an eyelet hole in it, to admit a warp thread to pass freely through it. This done, the next thing is to attach a small lead of about 2 ounces in weight, and 5¼ inches in length, midway between the valve on the side of the air tube and the warp thread. As soon as a thread breaks, its cord, is of course, disengaged, when its weight is allowed to drop through a small hole in a plate, which serves to guide all the weights, and by its descending force, depresses one end of a lever which acts upon the safety valve, (corresponding to the thread,) and by this means a sufficient quantity of air is allowed to escape from the general reservoir, which instantly rushes into the figure No. 1; whereupon that figure, by the aid of a very ingenious piece of mechanism in its inside, elevates the trumpet, and gives a shrill blast, loud enough to be heard all over the factory.—A similar method is employed with the weft threads, but this I shall explain to you in another letter, as soon as I hear from our friends, Dr. Lepsius, and Mr. C. G. G. of Oxford, to whom I have written on the subject. Should more than one thread break at a time, the mechanism of the figure No. 1, adapts itself to that incident, by giving a corresponding notice; should any serious accident occur, such, for instance as any of the workmen who are occupied inside of the machine falling through the rigging, by reason of having made a mis-step, then, the alarm loon blows five times in rapid succession; and in case of two hands falling over-board at the same instant, as is represented in the drawing, the trumpeter blows *eleven* times, lifts his reserve foot, kicking off his ring hat, under which all the tubes from the safety-valves in the main cylinder fit, whereupon the whole of the air escapes through the lid in the crown of the loon's head, and thus the loom is effectually stopped until new hands are provided.

I am credibly informed by his Highness, that in no instance do any of the poor fellows survive a fall from the engine, and, indeed, it is an astonishing fact, that life almost invariably becomes extinct before they reach the ground at all. It appears from the original records in the possession of his Highness, and from what I, myself, could decipher from *other* documents, in regard to the rise and progress of this desperately complex machine, that out of every 76 persons who met a horrid death through its instrumentality, 65 were apprentices (or green hands.)

There is not the shadow of a doubt on my mind, however, that

you will in the course of a short time, so improve the internal arrangements of the engine, as to lessen the number of these dreadful accidents, if not altogether to prevent such occurrences from taking place in future. *In a country like yours, where one man's life is just as valuable as any other man's*, this is a matter which requires your serious consideration, and all the ingenuity you possess. You ask the reason why so many workmen lose their lives in this business, but I confess my inability to give you any very definite reply to such a question, not having sufficiently weighed the subject, as yet, in all its bearings. However, my present impression is, that the principal cause of these misfortunes may be ascribed to the circumstance, that the mechanism is so extensive inside as to monopolize nearly all the footing or standing place; and as some parts of the machinery require to be operated by the hand, and others by power, it often occurs that the workman, from inattention, or want of experience, fails in performing his part of the work within the necessary time, and the section on which he stands is the next to be operated upon by the air cylinder, and should he not shift his position before it begins to open its jaws, he is at once let through the *slide*, receiving at the moment of his exit, a knock from a revolving guard or automaton figure, which is placed under the platform of the main pattern-board levers, for the purpose of clearing away obstructions, such as dead bodies, &c.; and as this knock or kick is commonly given on the crown of the head, life, in most cases, becomes extinct instantly.

Now, my dear sir, could you do away with the manual labour, by the substitution of power; or could you make such alterations, that the men would have a sure standing place to work upon; I say, could you make either of these improvements, I am of opinion, *and so is his Highness*, that you would confer a lasting benefit on mankind, at least on those who are called weavers.

You desire me to explain the meaning of the figures 2, 3, 4, 5, 6, and 7, as you say you are not much skilled in the science of hieroglyphics. You will, no doubt, have observed that they are all female musicians. Each of them wears on her cap the symbol of her rank in the band. Perhaps figure 5 is an exception, however; as I am not so certain of her grade. At first sight, I took her to be a pawnbroker's wife, from the fact of her wearing three balls to her horns; but she is so curious altogether in appearance, that I shall not venture to give any other opinion about her, until I hear from our friend Dr. Lepsius, and I intend writing to him on the subject to-morrow. As soon as his answer arrives, I will give you a com-

plete explanation of that figure, I will also write by the same post, to our learned friend Uleg Beg, as he doubtless, knows all about it, having lately turned his attention to these subjects; and, in the meantime, believe me to be, with permission from his Highness,

Your most obedient servant,

ALEXIS KERSIVENUS,

Civil Engineer, Homeopathic Physician, &c.

P. S. My family are all well. Cleopatra sends you her love, and three embalmed kisses, together with a vial of frankincense; and hopes soon to

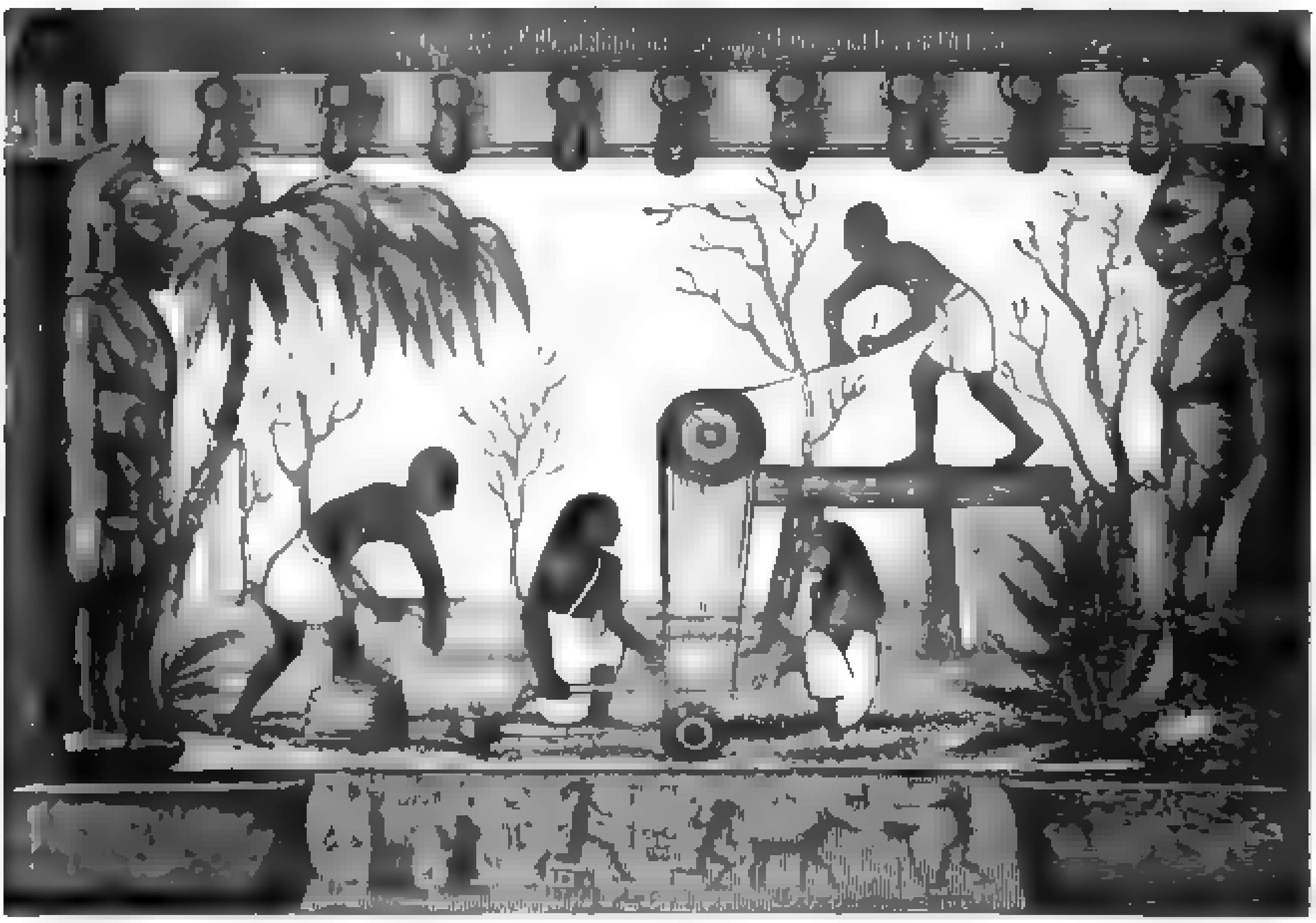
* * * * * !

Had some of our modern inventors seen this loom, with its various appurtenances, it might have saved them many an aching head and broken heart; and, we have no hesitation in saying, that it would have effectually shown them how far they had been anticipated by an unpretending individual who never even so much as thought it worth while to *secure* its benefits to himself by "Letters Patent." Although Arphaxad lived in a period of the world in which, it is generally supposed, men knew comparatively little, still we think that his specification, as delivered by himself before the Median monarch, is scarcely to be equalled by our greatest scheming-inventors and patent agents of the present day; and we would recommend it as a model to all those aspiring spirits who *expect* to reach the uppermost step of fame's ladder, or to have a bronze monument (higher than the Colossus at Rhodes) for a head piece to their narrow stripe of territory, after Chaos has spread his dusky pinions around their once ambitious intellects. However, this is none of our business.

But, to return to our subject, it appears that one of the most valuable of Arphaxad's inventions, was that of his improved *shuttle ;* for, as we have already stated, that useful implement in weaving, seems to have been entirely unknown to Ghelen; and, indeed, no great progress could ever have been made without it. Shuttles were made of two sorts, one for the fly, the other for the hand-loom, and were pointed at both ends in a similar way to those of the present day, that they might more easily pass through the shed, or sheds of the warp, opened for their reception. In spite of all this, however, the Yankees have the hardihood to claim the merit of having invented the fly shuttle, for one Mr. Samuel Slick, in the year 1738; and even Doctor Motherwell, shows his depth of learning in weaving chronology, when he reiterates the silly story which prevails upon the subject among the ignorant, in his Sketch of the Progress of the "Sheet and Blanket Manufactures, &c."

The following illustration is a correct copy of an original drawing taken from the tomb of Hassian; and we are indebted to the French Consul at Athens, for his great kindness in procuring it for us. It is shown at Fig. E.

Fig. E.



On comparison with Ghelen's loom, it will be observed that in the present drawing, double the number of hands are employed; and unless these could produce more than twice the quantity of cloth woven in the former, no *saving* would be effected. Perhaps, however, the quality of the fabric was improved by the 'let off' and 'take up' motions, which, no doubt, worked very admirably; more so, we think, than some of those at present in use; and we would add, might be advantageously employed on many of our modern carpet power looms.

The scene presented on the border at the bottom of the above drawing, is the pattern at which the weavers are engaged. It is somewhat indistinct, but so far as we can learn, the subject of it is a retreat from a battle-field. The large quadruped towards the right, is a jackass, and the person who holds it by the tail, is its owner, who appears to be one of the vanquished, and is leaving the scene of action with all possible speed, at the same time doing all in his power to save his ass; but it stands still, either from natural stubbornness, or from fear of one of the victors, who has got in front,

and is endeavouring to catch it, or else to tempt it with a * * * , which he has placed upon a three-legged stool. The man towards the left, who seems to run so fast, is another of the conquerors, and he will, no doubt, soon overtake the ass-driver. He carries, in triumph, upon a pole, the head of some person, whom he has killed in the fight. There is also on the left the figure of a person in a kneeling attitude, who has been taken captive, begging to the leader of the victorious army for his deliverance. The other details which help to compose the design, are merely fragments of the vanquished left on the field, such as coats, pantaloons, vests, helmets, legs, arms, &c.

The loom was also used as an embroidering frame, the figure or patterns being worked on the web with small shuttles or circles, as the weaving proceeded, but in some instances the embroidering needle was used instead of the shuttles: these needles were not similar to a common shirt needle, as some of our learned doctors would fain have it, but like those used in the manufacture of Gobelins tapestry; of these we shall have occasion to speak more fully hereafter.

According to Pope Leo X., Joseph's coat was woven in Ninevah, by Arphaxad's loom; but this statement, although made by his Holiness, cannot be relied upon, as we find it recorded by Basharaboo, a Persian author of *some* reputation, that Jacob obtained the cloth "of many colours" from one Boz Hassarac, a Babylonian pedlar.*

It appears from Exodus, chap. xxv. verse 4, that fabrics of blue, purple, fine linen and goats' hair, were manufactured to a great extent in Palestine. We read in Exodus, chap. xxvi. verses 1 and 2, "Moreover, thou shalt make the tabernacle with ten curtains of fine twined linen, and blue, and purple, and scarlet: with cherubims of cunning work shalt thou make them. The length of one curtain shall be eight and twenty cubits, (51 ft. 1 inch,) and the breadth of one curtain four cubits: and every one of the curtains shall have one measure." From this we perceive that the web in the reed, or reeds must have stood about 7 feet 3¼ inches, which is wider than any plain linen fabrics we manufacture at the present day. The figures of the cherubims must have been woven with shuttles, and very likely as many as a thousand shades of colour

* On the Babylonian carpets, says his holiness, Pope Julius I., were woven representations of those fabulous animals, the dragon, the griffin, and the nightmare, in all their varieties.

were made use of. Had they been done with the embroidering needle on so very wide a fabric, it would have taken an age at least in its accomplishment. In Exodus, chapter xxviii. verse, 37, we read as follows: "And thou shalt put it on a blue lace, that it may be upon the mitre." See also Exodus, chapter xxxix. verses 21 and 31. From this it is evident that the manufacture of lace was then well understood; and, indeed, it was so long before, in Egypt, as we shall endeavour to show.

We are well aware that in order to manufacture lace, very complex contrivances must be employed, for even with the best Nottingham machinery of our own day *twelve* distinct motions are necessary to complete one mesh.

On referring to the 28th chapter of Exodus, at the 39th verse, we learn how particular were the directions given to Moses regarding the preparation of the sacerdotal robes, to be worn by the high priest: "Thou shalt embroider the coat of fine linen, and thou shalt make the mitre of fine linen, and thou shalt make the girdle of needle-work." The concluding part of this verse shows most decidedly that the principal portion of the fabric was effected by machinery (perhaps like our friend Josué Heilmann's, of Mulhausen, Alsace, France,) otherwise, why should such particular reference be made to the girdles being of needle-work? No doubt, Bezaleel, an ingenious artizan of the tribe of Judah, invented machinery for embroidering those beautiful fabrics very expeditiously: this gentleman also made great improvements on the barrel, and draw looms, the claims of Morton of Kilmarnock, Cross of Paisley, and Bonnar of Dumfermline to the contrary notwithstanding. Aholiab of the tribe of Dan, one of Bezaleel's *particular friends*, made an improvement on one of his (Bezaleel's) machines, which, according to pope Leo X, was named "ogizigo;" this improvement, consisted in substituting vertical wires with hooks or lifters, through which wires, other horizontal ones passed, working through holes in a board, against slips of tin or copper, precisely the same way as in the Jacquard machine. It must be confessed that this is a most remarkable circumstance. These two celebrated workmen (Bezaleel and Aholiab) "were filled with wisdom of heart to work all manner of work of the engraver, and of the cunning workman, and of the embroiderer in blue, and in purple, in scarlet, and in fine linen, and of the weaver; even of them that do any work, and of those that devise cunning work." (Exodus, xxxv. 35.)

Moses also makes mention of the preparation of gold in threads, to be interwoven with the most precious cloths. "They did beat

the gold *into thin plates, and cut it into wires,* to work it in the blue, and in the purple, and in the scarlet, and in the fine linen, with cunning work." (Exodus xxxix. 3.) From this passage it is evident that gold thread, or rather wire, was used in weaving, which thread or wire it also appears, was cut by the aid of a very ingenious contrivance invented by one Zurishaddai, a native of Sidon. We regret that in spite of our endeavours to obtain drawings, or description of this apparatus we have, as yet, been unsuccessful.

We also learn the important fact, that in the times to which we refer, cochineal was known, as well as the mordants, to give brilliancy to the dye; for cochineal being a natural production of the East, it is unreasonable to suppose that its qualities were hidden from the ancients. According to Aristotle, the Chinese made use of it for ages before the Jewish dispensation (Ure's authority to the contrary notwithstanding.)

The cutting of gold into wire, to be woven into cloth, as before observed must have been effected by means of an astonishingly ingenious contrivance, (indeed, it must have been a very shaving machine) because we know from a sample of the cloth which we saw at Rome (in April 1831) that such wire was nearly as fine as No. 205, of our cotton yarn of the present day. While this curious specimen was being exhibited to us we asked the showman, if it was an identical sample of Bezaleel and Aholiab's manufacture, when, with a sarcastic sneer which we shall never forget, he pointed to his Holiness' certificate, affixed to it, remarking, that if heretics wanted any further proofs of its genuineness, they might go to the —— himself and enquire!

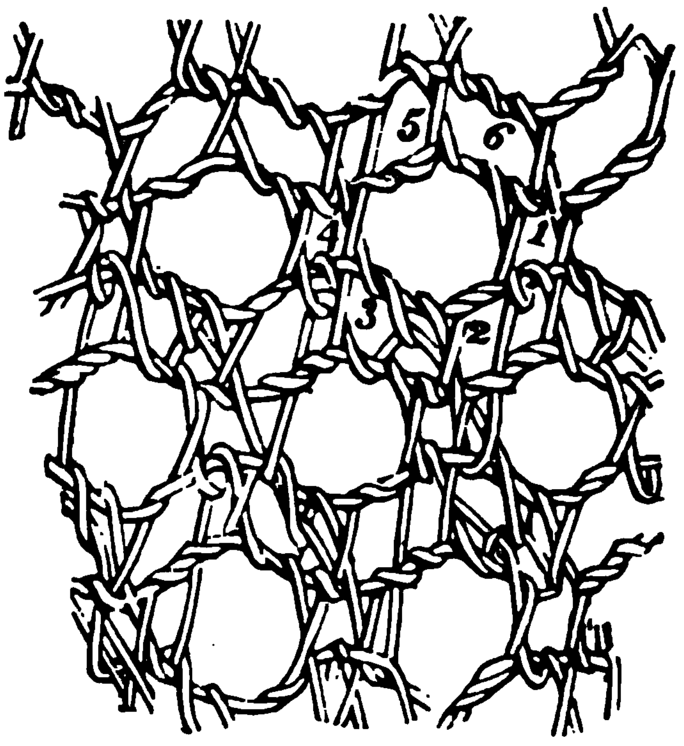
We find that the finest kinds of Egyptian net or cross work makes a very near approach to the modern lace, (see cross weaving.) Indeed, whatever knowledge we possess of lace-making, in any shape, we are indebted for it to eastern genius, and which we think no one will be foolish enough to question, after consulting the proofs we have already given, or shall yet give in the course of this work.

In the prophet's denunciation of Divine vengeance against the land of the Pharoahs, he particularly threatens the *flax, net, and lace manufacturers:* "Moreover, they that work in fine flax, and they that weave net-works shall be confounded." (Isaiah, xix. 9.)

The thin upper dresses worn by Egyptian ladies of *noble descent,* which were so delicate as to be called *woven air,* appear to have been lace of a very fine mesh, (being only 3-8ths of an inch in diameter.)

EGYPTIAN SHEBETZ.

'NET-WORK,' OR 'OPEN-WORK.'



We have, after three years and five months of unceasing research, at last procured the above extraordinary specimen of net-work or lace, known to the ancients by the appellation of 'open-work,' and of which mention is so frequently made in the scriptures. Our drawing was made from a piece of cloth 2¼ yards in length, by 45¾ inches in breadth, which now forms part of the curious collection of his Highness Mehemet Ali, the present vice-roy of Egypt. We are assured by our friend, the British Consul at Cairo, that its genuineness is unquestionable, and as for the faithfulness of our representation, nothing more need be said, than that he copied it himself from the original, and that too upon exactly the same scale.

The machinery used in the manufacture of this kind of lace must have been astonishingly complicated, for the threads are so miraculously linked, crossed, and twisted together, that we are really surprised that it could ever have been produced at all. There are two kinds of meshes in this sample, the smaller ones, which we have marked 1, 2, 3, 4, 5, and 6, surround one of the large kind, giving it the appearance of a honey comb. This net bears a close resemblance to the Grecian net, but it is on a miniature scale in comparison. In the Grecian, each large mesh is surrounded by ten small ones, so that there is a greater disproportion between the sizes of the meshes than in our specimen. There is little difference in other respects, however.

Through the instrumentality of our old friend, Alexis Kersivenus of Alexandria, we have also received another specimen of Egyp-

tian net, of an entirely different stamp, and which will be described in the part of this work headed "lace manufacture."

A small piece of carpet, or rug, has lately been brought from Egypt, and is now in the possession of lady Hamilton of Amsterdam. It is fifty-six and a half inches long, and thirty-six broad; and is made, like Brussels carpeting, with woollen warp for the face or pile, and linen twine for the back. In the middle is the figure of a fox in scarlet, with a night owl above it, the hieroglyphic of 'rogue,' upon an orange ground; around which is a border composed of blue and purple lines; the remainder is a ground of light pink, with violet figures of the pelican and curlew above and below, and on each side crimson outlines with bright yellow ornaments; and the outer borders are made up of white, blue, and green lines about $\frac{3}{8}$ths of an inch wide, each line having fancy devices projecting from it, with a triangular summit which extends entirely round the edge of the carpet.

Sir Gardiner Wilkinson also gives us an account of a small carpet rug of Egyptian manufacture, which he says is now in the possession of a Mr. Hays. It does not differ very materially from the one just noticed. "This rug," says Sir G. W., is eleven inches long, by nine broad. It is made, like many carpets of the present day, with woollen threads on linen strings. In the centre is the figure of a boy in white, with a goose above, the hieroglyphic of a 'child,' upon a green ground; around which is a border composed of red and blue lines; the rest is a ground of yellow, with four white figures above and below, and on each side are blue outlines with red ornaments; the outer border being made up of red, white and blue lines, with a fancy device projecting from it, having a triangular summit, which extends round the edge of the rug. Its date is uncertain; but from the child, the combination of the colours, and the ornament of the border, I am inclined to think it really Egyptian."

It is obvious that with such a piece of mechanism as Arphaxad's vertical loom, and the use of several colours splendid patterns could be produced.

It is narrated that Arachne, a woman of Colyphon (daughter of Idmon, a dyer) was so skilful in working tapestry, that she challenged Minerva, the goddess of the art, to a trial of skill. She represented in her designs, the amours of Jupiter with Europa, Antiopa, Leda, Asteria, Danae, and Alemene; and although it is recorded that her performances were masterly, yet she was defeated

by Minerva, and hanging herself in despair, was changed into a spider by the goddess. Ovid describes the very ungallant use to which Minerva applied the shuttle, in her contest with Arachne:

> " A great fly shuttle in her hand she took,
> And more than once Arachne's forehead struck;
> The unhappy maid, impatient of the wrong,
> Her injured person from the breast beam hung."
> (*O'Doherty's Trans.*)

Of the manufactures of India we can convey to our readers no better idea, than by giving Dr. F. Buchanan's description of them, which we copy from his second volume of a manuscript account of Behar and Patna, preserved in the library of the honourable East India Company.

" A great deal of the cotton is freed from the seed by the women who spin it, and a part of this is also beaten by the same persons; but the Dhuniyas, who make a profession of cleaning and beating cotton, separate the seed from some, and beat the greater part. Perhaps one third of them have stock enough to enable them to buy a little cotton, which they clean and then retail; the remainder work entirely for hire. A man and his wife can make from three to four rupees a month. In country places they are often paid in grain. At Arwăl they are allowed 1½ sērs of grain for beating one sēr of cotton; and in one day a man beats four sērs (45 S. W.) equal to about 4½ lbs., and of course receives 6¾ lbs. of grain. Those who have a little capital may make 4 or 5 rupees a month.

"In every division I procured an estimate of the proportion of women who spin cotton, of the average quantity of cotton that each spins, and of the value of the thread. Such estimates are liable to numerous objections; but it is probable when a number of them are taken, that the errors of the one will be nearly corrected by those of the others, so that the average will not be far from the truth. Allowing that the women of an age fit to spin are one-fifth of the population, the estimates that I procured will give for the whole thus employed 330,426 spinners. Now by far the greater part of these spin only a few hours in the afternoon; and, upon the average estimate, the whole value of the thread that each spins in the year is worth nearly 7R. 2A. 8P., giving for the total annual value 2,367,277 rupees; and by a similar average calculation, the raw material, at the retail price will amount to 1,286,272 rupees, leaving a profit of 1,081,005 rupees for the spinners, or 3½ rupees for each. But there are many women who spin assiduously, and who have no interruptions from

husband or children, and these make much more, especially where the thread is fine; there being no sort of comparison between the reward allowed for such, and that given to those who spin coarse thread. As the demand, therefore, for fine goods has been for some years constantly diminishing, the women have suffered very much. Another calculation agrees so well with the above that I have little doubt of the general accuracy of both. An estimate was made in each of the divisions of the number of looms employed, of the quantity and value of thread required annually for each, if employed in working at the usual rate, and the most usual kind of goods, and the following is the result:

		Rupees.
Cotton thread required	for cotton cloths, - - - - - -	2,229,979
do.	for mixed cloths, - - - - - -	101,762
do.	for tape, carpets, tent-ropes, &c., - -	37,125
do.	for sewing thread, &c., - - - -	2,000
		2,370,866

"Some thread is both exported and imported. Taking the amount of the statements, the excess of that imported will be worth 30,500 rupees, which could reduce the demand on the thread of this district to about 2,340,356 rupees in place of 2,367,277 rupees, which I have allowed to be spun; but, at Bhagalpur, it was said that 1,450 rupees worth of thread was there imported from Patna; and at Puraniya there is imported to the value of 12,000 rupees, of which a half comes probably from the same town, while the merchants here only allowed an export of 3,420 rupees.

"The whole thread is spun on the small wheel common in India, and the implements for cleaning and beating the cotton are not different from those that are usual. No rank is considered here as degraded by spinning.

"The cotton weavers are numerous. Those of Phatuha are employed in weaving cotton diaper, (khés,) which the natives use as a dress; but the great demand is for Europeans, who use the manufacture for table linen. By far the greater proportion of the cotton weavers is employed in making coarse cloths for country use, but a good many make finer goods for exportation. The amount of thread required is 1,771,379 rupees, and the value of the cloth 2,438,621 rupees, leaving a profit of 667,232 rupees, or 28½ rupees for each loom. It may be supposed that the finer qualities of goods taken for exportation would diminish the value of the raw material, and increase the total value of the commodity, but that would not appear to be the case. Although the quantity of thread is no doubt

less, yet as the reward for spinning the fine is much higher than that for spinning the coarse, the actual value is perhaps a little higher than I have stated, and may reduce the average profit to 28 rupees a year for each loom. Each man on becoming bound (asami) to the Company receives 2 rupees, and engages not to work for any person until he has made as much as the Company requires; no other advance has ever been made by the commercial residents. The agent orders each man to make a certain number of pieces of such or such goods, and he is paid for each on delivery according to the price stated in the tables. This shows clearly that the system of advance is totally unnecessary; but it is here pursued by all the native dealers, as keeping the workmen in a state of dependence, little better, if so good, as slavery.

"The loom is of the imperfect structure usual in India; and where starch is used to facilitate the working, it is made from the root called kandri. It must be observed that all the Indian weavers who work for common sale, make the woof of one end of the cloth coarser than that of the other, and attempt to sell it to the unwary by the fine end, although every one almost who deals with them is perfectly aware of the circumstance, and although in the course of his life any weaver may not ever have an opportunity of gaining by this means. The same desire of illicit gain induces him almost universally to make the pieces somewhat shorter than the regular length.

"The coarser goods intended for market sale are always sold as they come from the loom, but those intended for private sale are all bleached, and many of them undergo operations by different classes of tradesmen. It must be observed that in this district the weavers were bound to act as porters for conveying the goods of travellers; and when any person of rank or authority calls upon the zemindar for such, the weavers are still required to perform this office. On some estates they are, on this account, allowed an exemption from ground-rent for their houses; on others they are taxed at a higher than usual rate.

"At Behar, a class of artists called parchahkush is employed to put all the threads in the bleached cloth at equal distances. (See the drawing marked Fig. A, of Arkite Ghiden Ghelen's loom, where this delicate operation is being effected by the female figure in front.) The cloth made there being very thin, the operation of bleaching brings the threads into clusters, leaving many parts almost in holes. These workmen place all the threads at equal distances with a wooden comb. In some other places a needle is used. Many fine

pieces of cloth are ornamented at the ends with a flattened gold and silver wire called bad-la, which, as the natives use the pieces entire, looks very showy. It is not woven into the cloth, but put in with a needle.

"The Chhapagars put gold and silver flowers on fine muslin by a very simple process. They stamp the cloth in the form wished with common glue, and then apply gold and silver leaf, which adheres to the glue, but rubs off where that has not been applied. Of course this cloth cannot be washed, but is very showy, and used only on high occasions."

THE ART OF WEAVING.

"The art of weaving is exceedingly old,
As we by king Deioces have been told.
'Tis said that *Ghelen* weaving first began;
Which hath descended since from man to man.
The mothers taught their daughters, sires their sons,
Thus in a line successively it runs
For general profit, and for recreation,
From generation unto generation.

Arphaxad was a weaver of great skill;
His four web engines make us wonder still;
For they do art so like to nature frame,
As if it were her sister or the same.
Flowers, plants, and fishes, beasts, birds, flies, and bees,
Hills, dales, plains, pastures, skies, seas, rivers, trees;
There's nothing near at hand, or farthest sought,
But with these famous air looms may be wrought.
In cloths of Babylon I've often seen
Men's figured counterfeits so like have been,
That if the party's self had been in place,
Yet art would vie with nature for the grace.
Moreover, poesies, rare anagrams,
Signifique, searching sentences for names,
True history, or various pleasant fiction,
In sundry colours, mixed with arts' commixion;
In all dimensions, curves, squares, ovals, rounds,
Art's life included within nature's bounds;
So that art seemeth merely natural,
In forming shapes so geometrical."

The art of weaving was unknown in Great Britain previous to the Roman Invasion. After the Romans had obtained a footing in that country, they established a woollen manufactory at Winchester, for clothing their army; and they also taught the benighted

natives the art of weaving, and the culture of flax. The Saxons afterwards introduced several kinds of fabrics for domestic purposes, among which are said to have been *knotted counterpanes with network borders*, for bed-covers, petticoats, pantalets, &c. In the early part of the fourteenth century (1327) Nicholas Grattan, Ned O'Neal, Brien Gallagher, and Jack R. Newbury introduced the manufacture of broad cloth, which manufacture was afterwards protected and encouraged by king Edward 3d, and this fabric has ever since been a staple article of export.

The following extracts, from "Anderson's Progress of the Arts and Sciences," and other works, will exhibit the state of the cloth manufacture in Europe up to the end of the seventeenth century; at which time a new era may be said to have begun, in the history of the arts in Great Britain and Ireland.

1209, Venice gains the silk manufacture from Greece.

1248, A company of Wool merchants settle in London.

1253, Some fine linen made in England. In the latter part of this century, the richer classes of the people wore *woollen shirts, with buckskin bosoms and collars*, and the ladies wore *goat's hair drawers*. The most influential citizen gave not above one hundred and five pounds sterling, three milch cows, and seven two-year-old heifers, for a daughter's portion; "but now," says Laffama, "we wear linen, and the women wear gauze chemises with lace ruffles, and silk gowns, some of which are embroidered with gold and silver." Table linens and serviettes were scarce in England at this time.

1305, The city of Louvain in Flanders, with the adjacent villages, said to contain above an hundred and fifty-four thousand journeymen weavers; many of whom worked with the double shifting harness boards, and five trap boards to one machine, with steel beads on the cords, instead of knots, which was *estimated at the time* to be quite an improvement.

1327, The first broad cloth made in England.

1331, King Edward 3d. resolves to establish the woollen manufacture, and for that purpose brings seventy-six families of Walloons into England.

1336, Two Brabant weavers (Whinging C. Shryzer and Frank Wiesse Farncopvf) settle at York, with the king's protection; "As it may prove," said the king, "of great benefit to us and our subjects."

1337, Laws enacted to encourage the woollen manufacture in England. Holland gains part of said manufacture from Flanders and Brabant.

1339, Looms set up in Bristol for making woollen cloth.

1348, Norwich eminent in the worsted manufacture. *French fashions* introduced into England, Ireland, and Scotland.

1351, French weavers numerous in London.

1376, Woollen cloth made in Ireland, by Nancy Carroll and Biddy Rooney, of Kilbeggs, Donegal county.

1380, The city of Louvain loses its manufacture, by an insurrection of the journeymen weavers.
1386, A company of linen weavers established in London.
1390, Coarse cloth (for corn-bags) made at Kendal.
1398, Foreign woollen cloths first prohibited in England.
1436, Coventry eminent for the woollen and cap manufactures.
1455, Some silk manufacture carried on by women in England.
1488, Woollen cloth not to be exported from England till fully dressed.
1519, Spain loses her woollen manufacture; which she has not been able to regain, to the present time.
1521, France first establishes a silk manufacture.
1533, Hemp and flax ordered by statute to be sown in England.
1537, Halifax, in Yorkshire, commences the woollen manufacture.
1549, King Edward 6th encourages foreign protestants to settle in England; viz., Walloons, Germans, French, Italians, Poles, and Swiss, who much advance manufactures and trade.
1567, & 8, Persecution of the protestants in France and the Netherlands, *by the papists*, under the duke of Alva, who drives many of them into England, where they establish a variety of manufactures.
1582, Value of woollen cloth exported from England, annually, £230,000.
1590, The manufacture of sail-cloth first introduced.
1597, Logwood forbid by law, to be used in dyeing; but afterwards found to be of great use.
1608, Silk-worms brought into England, from France.
1614, Dyeing of wool first practised by one Andy Ure, an apothecary from Glasgow.
1619, Tapestry work first introduced into England, by Tranquille Le Roy of Paris.
1620, Broad silk cloth first manufactured by Alexander Haenal of Berlin.
1622, The woollen manufactures of England in a declining state.
1624, The Dutch make woollen cloth to the annual value of £125,000.
1641, Linen yarn spun in Ireland, and sent to Manchester, where it is woven into cloth, and in that state returned for Irish use.
1643, Scarlet dye first made in England; then called 'bow dye.'
1646, The French begin, with renewed energy, their manufacture of fine woollen cloth, under the patronage of cardinal Mazarine, at Sedan.
1650, The worsted manufactures of Norwich incorporated.
1654, The fine broad-cloths of England sent to Holland to be dyed.
1663, Forty thousand men, women, and children, (mostly French) employed in the silk throwing business in, and near London.
1666, Garters, suspenders, and whiskey introduced by father Teague O'Roorke, a native of Antrim county, Ireland.
1667, Dyeing and dressing of woollen cloth begun in England by Warfyde Duysters, of Antwerp, and Charles E Brewer, of Mechlin (Malines.)
1668, The Irish send linen yarn to England.
1670, The wear of muslin first introduced. The linen manufacture begins to be encouraged in Ireland.
1685, Seventy thousand refugees came from France, on the revocation of the Edict of Nantes, (by which edict the protestants there, enjoyed the

free and public exercise of their religion) and settle in Great Britain and Ireland, bringing with them the blessings of industry, and an extensive knowledge of many manufactures and arts hitherto unknown in the latter countries. Of these refugees two thousand five hundred and seventy-six went to Dublin, Belfast, Sligo, and Londonderry. The whole number who for conscience' sake left their native country, is said to have been 803,000. They distributed themselves in Holland and Brandenburg, where they established the manufacture of cloth, serges, stuffs, druggets, crapes, stockings, and hats; and they practised all sorts of dyeing. Among these people were goldsmiths, jewellers, watchmakers, carvers, apothecaries, and *incubationists* (egg hatchers by steam.) Many settled in Spitalfields, London, where they began the manufacture of silk; and others located around Soho and St. Giles. Some of them introduced the art of making chrystal eyes, (for old bachelors, &c.) which art was entirely lost to France.

1696, A law passed in England, to prevent the exportation of wool, and to encourage the importation of Irish hemp, flax, linen, thread, butter, and pigs. By this law these articles were admitted duty free; which *liberal policy* gave rise to the now flourishing state of trade in Ireland!

From these extracts it will appear, that Britain and Ireland were first indebted to the *bigotry, and persecuting spirit of the popish powers of Europe*, in the sixteenth and seventeenth centuries, for most of the useful arts which they now enjoy; and which arts form the basis of our most extensive manufactures.

The cloth manufacture made little progress in Scotland till after the Union, when it was greatly promoted by the fostering care of a board of trustees, which was established by charter at Edinburgh, in the year 1727, for the purpose of protecting the Scotch manufactures and fisheries. The greater part of the goods made there were of linen yarn, till the year 1759, when a branch of the silk trade from Spitalfields, was established at Paisley; where it was brought to such perfection, especially in the light and more fanciful kinds, that in a short time, Paisley silks almost rivalled those of France.

About this period the increasing demand for cotton goods induced several individuals to attempt a more ample supply of yarn, to meet an extension of this branch of art, but all without success, till the year 1767, when Richard Hargreaves, a weaver in Lancashire, invented the spinning jenny; which at first contained only eight spindles, but was afterwards enlarged so as to contain twenty, thirty, and even eighty. About two years after Hargreave's invention took place, Richard Arkwright, a *barber*, improved the spinning of cotton still further, by the application of water for the mov-

ing power, together with the addition of rollers and other modifications of the machinery. The extension of this rising manufacture now became so rapid, that it would soon have felt a serious check, had not the discoveries in chemistry which were made about the same time, come to its aid; particularly in the processes of dyeing and bleaching; by the latter of which the manufacturer is enabled to bring his goods to the market a few hours after their being taken from the loom, whereas, by the old method, it would require as many months.

These inventions and discoveries, together with the improvements in calico printing, the discharging of colours, (particularly of Turkey red, for Bandannas) the application of steam as a moving power, in weaving plain cloth, and innumerable other mechanical inventions, which it would be tedious even to name; these have, within the last fifty years raised the cotton manufacture to a state of perfection, which has no parallel in the history of the arts.

It will be remembered by the reader, that Mr. Kersivenus, in his letter of 23d April, 1843, (given at page 34,) promised us some further information relative to the subjects there spoken about; and after some unavoidable delay, this gentleman has at length written another letter to us, of which the following is a correct translation. No doubt his document will be interesting to many weavers and manufacturers in this country.

Alexandria, 17th Sept. 1843.

Dear Friend:

Your letters of 9th July and 15th August came to hand, and their contents I have just been considering with the greatest attention.

I am happy to hear in the first place, of the safe arrival at Ardoyne, Belfast, of the letter which I had the pleasure of writing you on the 23d of April last. I regret exceedingly not having been able to give you more correct information, on the subject to which you most particularly refer; but this delay has been altogether occasioned by the negligence of Messrs. Lepsius and Taylor, in not answering my letters to them, of 24th April.

For the last fortnight my life has been a burthen to me, as I have been suffering from a sore disease, which *quack doctors* generally call *delirium tremens.* I subjected myself to homeopathic treatment, however, about ten days ago, and am now so far recovered as to be able to keep the children in order, although I cannot yet undertake any *professional duties.*

On examining various letters and other documents, received by this morning's mail, I was extremely delighted to see a communication in the handwriting of our old friend Lepsius, enclosing, also, another from Mr. Taylor. These documents, although certainly not so satisfactory as I could wish, contain, nevertheless, various observations relative to Arphaxad's inventions, which may, to some extent, answer your enquiries; and I shall now submit to you the substance of what they state as briefly as possible.

Figure No. 5, in the drawings, puzzles both the Doctor and Mr. T., and they frankly confess, that they neither know what kind of a character she is, nor yet the object for which she is represented at all. Mr. T., however, suggests from the implements which she carries, that she is a person perfectly skilled in the arts of spinning and figured weaving. Figure No. 8, is a portrait of the prince of weavers, no less than E. K. Arphaxad himself; but this, I think, you might have seen yourself, without any explanation. The fragments of machinery, and other articles scattered over the drawing, according to Lepsius, originally constituted part of the interior mechanism of the engine; but have been thrown into their present state of confusion by a dreadful explosion of the principal air cistern, killing, instantaneously, two beautiful ladies, who were mere spectators, come to the factory, for the purpose of examining some new patterns of shawls, lace, and quilting stuffs, for their wedding dresses. It is somewhat singular that this frightful catastrophe should have happened on a *Sunday*; which circumstance is another proof of the bad effects of working on that day.

You will perceive in the drawing, the wreck of many valuable contrivances used by weavers. Among those may be traced part of Lemuel P. Arybas' nipper or jaw temple, Arphaxad's tappet wheel, fork and grid stop-thread motion, measuring rollers for regulating the giving out of yarn from warp beams by means of endless screws, &c., lace and embroidering machinery of various kinds, cams and cam-wheels, with a variety of spinning apparatus, which, to all appearance, judging from the figures, is at least equal to the best spinning machinery of the present day.

From these remains it would seem that Arphaxad's loom was capable of producing various textures at one and the same operation. Indeed, Lepsius informs me that Arphaxad constructed a machine for Gengis-Khan, adapted to weave 30 pieces of cloth at once, these pieces varying in width from 25 to 74 inches, and forming the most beautiful textures and patterns imaginable; surpassing in splendour of appearance even the most gorgeous tail of the peacock, and dis-

playing a greater variety of colouring than that proud bird can boast of. This machine, although containing so many webs, and working so many shuttles (averaging 30 shuttles to each of the 30 webs, or 900 in all) appears to have cost only 1 *shekel* of silver per diem for the necessary driving power. The proprietor, therefore, must have realized a handsome profit while the engine was in successful operation, in as much as it turned off 1200 yards daily, of perfect goods, with the assistance of a mere child to superintend it. The average price at which the cloth was sold per yard, taking one web with another, was about 75*l.*; and the cost of the raw material was not over 30 per cent of that sum, the cloth being extremely light, owing to the astonishing fineness of the thread used. The original cost of the machine, however, formed an important item, as it was not less than 140,000*l.* of your money. Lepsius is unable to say whether this enterprise turned out a good speculation for Gengis-Khan, or not, as he cannot ascertain how long the loom was in operation before it *blew up*.

From these *facts* we may take it for granted, that the fragments shown in the drawing *did* actually form part of the mechanism of the engine represented, previous to the explosion of the air cistern; the spinning machinery, no doubt, being employed in furnishing the different warps and wefts as required. Whether the thread used was of gold or silver, neither the Doctor or Mr. Taylor is able to say; but, in my opinion, gold was the material used, to which the necessary endless variety of shades had been previously given by some highly ingenious chemical process. Had the thread not been of gold, the textures could not have been so expensive.

The specimen of cloth in possession of his Highness, and of which I spoke to you in a former letter, although 5,331 years old, yet it is beautiful beyond conception—*as fresh and perfect as if finished yesterday*. This specimen contains 130 shades of colour, and is of pure gold. I shall forward you in a few days 11¾ inches of it, which I have procured from his Highness at an expense of 90 shekels of gold. The pieces of glass cloth which you had the kindness to send me, are not to be compared to it in richness of colouring and design.

Regarding the spinning engine of Wallotty Trot, the Doctor thinks it did not differ materially from that demolished by the explosion, part of which is shown at No. 9.: but whether Trot used rollers, as at No. 10., or flyers, as at No. 11., neither Lepsius nor Taylor can decide.

Since writing the above, my son has found another paper, among

those brought this morning, from Doctor Lepsius, who has elicited some further ideas relative to the figures 2, 3, 4, 6, and 7. He says they are mechanical or automaton musicians which were stationed, generally, at the entrance of the manufactory, for the purpose of serenading ladies and gentlemen who came to purchase the splendid productions of Arphaxad's looms. These figures serenaded all good customers, also, when leaving the factory; but in no case would they play a single note to such as were shabby in purchasing. Each figure was possessed of the necessary mechanism, in its interior, according to its office in the band. The playing of a tune, commonly averaged from 35 to 45 minutes; and there were 140 tunes, in all, "to the round." Each automaton was furnished with a suitable key, by means of which *it wound up itself* when run down.

In regard to stopping the engine on the breaking or failure of a weft thread, no difficulty could have been experienced; because the fork and grid stop thread motion, (a fragment of which you will perceive in the drawing,) would accomplish that object effectually. Besides, there are evident traces of other valuable contrivances for the same purpose: but whether these were ESSENTIAL to the perfect working of this extraordinary loom, or not, is at this moment a mystery beyond my power to solve.

His Highness is delighted with the working of your power looms; he has lately caused them to be set up in his turban factory, and they are now in successful operation. He requests me to convey to you the expression of his sincere regard, in the shape of * * * * * , and shipped this day on board the Royal Tar. I herewith enclose the invoice.

I have just learned that our respected friend, Amasis Osirtasen, is no more, having departed this life yesterday (Sunday) while in the act of * * * * * * * * * * * * !

Hoping the above information will prove satisfactory, I remain, with permission from his Highness,

Your most obedient servant,

ALEXIS KERSIVENUS,

Civil Engineer, Homeopathic Physician, &c.

Manufactures of the United States and Imports of Manufactured Goods in 1839-40.

	Home Manufactures.		Imports.
Woollen	$20,696,999	-	$6,832,846
Cotton	46,350,453	-	5,504,484
Silk	119,814	-	10,011,750
Flax	322,205	-	435,346
Mixed	6,545,503	-	3,201,000
Tobacco	5,819,658	-	859,833
Machinery	10,980,581	-	——
Hardware, &c.	6,451,967	-	2,568,070
Cannon—small arms	2,654,540	-	118,589
Precious metals	4,734,960	-	622,549
Various "	9,779,442	-	2,937,000
Granite, &c.	2,442,950	-	——
Bricks and lime	9,736,945	-	——
Hats, caps, and bonnets	10,179,848	-	445,698
Sole leather	15,586,258	-	——
Upper "	9,455,670	-	——
Other "	13,134,403	-	473,091
Soap and candles	5,487,436	-	96,307
Distilled liquors	10,350,656	-	1,592,000
Fermented "	4,653,556	-	148,099
Gunpowder	1,077,341	-	4,521
Drugs, paints, &c.	4,151,899	-	2,130,140
Turpentine, &c.	660,827	-	——
Glass	2,800,208	-	202,000
Earthenware	1,104,825	-	2,010,231
Sugar	7,250,700	-	5,581,950
Chocolate	79,900	-	1,294
Confectionary	1,143,985	-	103
Paper	6,153,092	-	70,100
Cordage	4,078,306	-	102,938
Musical Instruments	923,824	-	——
Carriages and wagons	10,891,887	-	——
Flour	37,022,810	-	——
Other produce of mills	76,545,246	-	——
Ships built	7,016,094	-	——
Furniture	7,555,405	-	234,751
All other manufactures,	34,785,353	-	4,000,000
Aggregate value.	$398,725,546		$50,184,690

A TABLE, *showing the total value of Imports and Exports, in dollars, of the United States in each Commercial year, commencing on the* 1*st day of October, and ending on the* 30*th of September, for a period of* 21 *years; and exhibiting, also, the excess of Imports and Exports in each year for the same period.*

Years.	Value Imp'ts.	Value Exp'ts.	Excess Imp'ts.
1821	$62,858,724	$64.974,382	
1822	83,241,541	72,160,281	$11,081,260
1823	77,579,267	64,699,030	2,880,237
1824	80,549,007	75,986,657	4,562,350
1825	96,340,075	99,535,388	
1826	84,074,477	77,595,322	7,379,153
1827	79,494,068	82,324,827	
1828	88,509 824	72,264,686	16,245,138

(*Table Continued.*)

Years.	Value Imp'ts.	Value Exp'ts.	Excess Imp'ts
1829	$74,492,527	$72,314,671	$2,176,856
1830	70,876,920	73,849,508	
1831	103,191,124	81,310,483	21,880,541
1832	101,029,266	87,676,943	13,852,323
1833	108,118,311	90,140,433	17,977,878
1834	126,521,332	104,336,973	22,184,359
1835	149,895,742	121,693,577	28,202,165
1836	189,880,035	128,663,040	61,316,995
1837	140,989,217	117,419,376	23,569,741
1838	113,717,404	108,486,616	5,230,788
1839	162,092,132	121,018,416	41,063,716
1840	107,141,519	132,085,946	
1841	127,946,177	121,851,808	6,094,369

Excess of Exports.

1821	$2,338,658
1825	3,195,313
1827	2,830,759
1830	2,972,588
1840	24,944,427

From this it would appear that during the twenty years preceding 1841 the imports have exceeded the exports to the amount of TWO HUNDRED FORTY-NINE MILLIONS, THREE HUNDRED SIXTY-SIX THOUSAND, ONE HUNDRED THIRTY-FIVE DOLLARS.

Statistical Table showing the aggregate amount of Manufactures of Cotton in the several States and Territories of the Union, viz :

	Cotton. Manufactures.	Number of Spindles.	Dyeing and Printing Estab.	Value of Manuf. Articles.	Persons Employed.	Capital Invested.
Maine	16	29,736	3	$970,397	1,414	$1,398,000
N. Hampshire	48	195,183	4	1,192,305	6,991	5,523,200
Massachusetts	278	665,095	22	16,553,423	20,928	17,413,099
Rhode Island	209	518,817	17	7,116,792	12,085	6,326,000
Connecticut	116	181,319	6	3,715,964	5,154	8,152,000
Vermont	7	7,254		113,000	262	118,100
Total	674	1,597,404	52	29,661,881	46,834	38,930,399
NORTHERN MIDDLE STATES.						
New-York	117	211,659	12	3,640,237	7,407	4,900,772
New-Jersey	43	63,744	13	2,086,104	2,400	1,722,819
Pennsylvania	106	146,994	40	5,013,007	5,522	3,225,400
Total	266	422,397	65	10,739,348	15,329	9,848,991
SOUTHERN MIDDLE STATES.						
Delaware	11	28,492		332,272	566	330,500
Maryland	21	41,182	3	1,150,580	3,274	1,304,400
Virginia	22	42,362	1	446,063	1,816	1,299,020
N. Carolina	25	49,934		488,800	1,219	995,300
Total	79	161,970	4	2,417,715	6,875	3,929,220

(*Table Continued.*)

	Cotton Manufactures.	Number of Spindles.	Dyeing and Printing Estab.	Value of Manuf. Articles.	Persons Employed.	Capital Invested.
			COTTON-GROWING STATES.			
S. Carolina .	15	16,335		359,000	570	617,450
Georgia .	19	42,589	2	304,342	779	573,835
Alabama .	14	1,502		47,547	82	35,575
Mississippi .	63	318		1,744	81	6,420
Louisiana .	2	706		18,900	23	22,000
Tennessee .	38	16,813		325,719	1,542	463,240
Total	151	78,263	2	1,057,252	3,077	1,718,520
			WESTERN STATES, &c.			
Kentucky .	58	12,358	5	329,380	523	316,113
Ohio .	8	12,358		139,378	236	113,500
Indiana .	12	4,985	1	135,400	210	142,500
Arkansas .	2	90			7	
Total	80	29,791	6	604,158	976	572,113
Aggregate in the U. States	1240	2,284,631	129	46,350,458	72,119	51,102,359

Statistical Table showing the aggregate amount of Manufactures of Silk, Number of Males, Females, and Children Employed, and Capital Invested in the United States.

	No. pounds reeled thrown or other silk made.	Value of the Silk.	Males employed.	Females employed.	Capital Invested.
		EASTERN STATES.			
Maine .	$9\frac{1}{2}$	$91	—	1	$125
New Hampshire	$82\frac{7}{8}$	924	5	26	865
Massachusetts	$4{,}633\frac{1}{2}$	38,079	30	116	68,719
Rhode Island	16	15	—	—	—
Connecticut	$6{,}901\frac{1}{2}$	55,485	23	100	85,430
Vermont	39	99	5	2	1,150
Total	$11{,}682\frac{3}{8}$	94,693	63	245	156,289
		NORTHERN MIDDLE STATES.			
New-York .	$377\frac{1}{2}$	2,415	35	66	8,034
New-Jersey .	$158\frac{1}{2}$	858	10	7	2,020
Pensylvania .	2,350	14,644	64	88	88,917
Total	2,886	17,917	109	161	98,971

(*Table Continued.*)

	No. pounds reeled thrown or other silk made.	Value of the silk.	Males employed.	Females employed.	Capital invested.
	Southern Middle States.				
Delaware	15	117	—	1	—
Maryland	40	—	2	18	5,000
Virginia	94	515	11	10	2,714
North Carolina	7	55	—	1	—
Total	156	687	13	30	7,714
	Cotton-Growing States.				
South Carolina	46	380	1	3	50
Georgia	97	458	11	7	955
Alabama	13	99	—	—	75
Louisiana	70	420	—	3	—
Tennessee	19¾	218	14	31	2,500
Total	245¾	1,575	26	44	3,580
	Western States.				
Kentucky	86	819	3	11	5,467
Ohio	652	3,740	23	27	2,290
Indiana	9	94	4	1	3
Illinois	17	235	—	1	10
Michigan	8	34	2	—	50
Florida	1½	15	—	—	—
Wiskonsan	1	5	—	1	—
Total	774½	4,942	32	41	7,820

Statistics of the Woollen Interest.

It appears from the last census that there were in the United States about twenty millions of sheep, which may justly be esmated as of the value of $2 per head, ... $40,000,000

Sheep farms generally do not support more than three sheep to the acre, for winter provender and summer pasture. The average value of lands on which sheep are kept, (taking the whole United States) cannot justly be estimated at less than twenty dollars the acre. The quantity of land required for said sheep, at three sheep to the acre, will amount to six million six hundred thousand acres, at $20, ... 132,000,000

A further agricultural investment is required to raise the timber, firewood, coal, teazles, food for team horses, and other wants of the manufacturers, which may be estimated at . 4,000,000

The above sheep will produce annually fifty millions of pounds of wool, estimating two and a half pounds to the fleece, which is rather under than over the real product.

To manufacture fifty millions of pounds of wool into cloth, would require on the average fifty persons, (men, women and children) for every one hundred thousand pounds of wool per annum; whole number employed would thus be 50,000.

It is a reasonable supposition that each laborer subsists two

other persons, increasing the number to 150,000 deriving a direct subsistence from the woollen manufacturers. Each person will consume per annum, of the products of Agriculture, in food, to the value of twenty-five dollars, and in the whole, to the value of $3,750,000.

The average products of farms, after subsisting the families and work hands of the farmer, will not yield over $2 50 per acre for sale. It will therefore require one million five hundred thousand acres of land to feed the operatives and their dependents engaged in the manufacturing of wool, worth, say $20 the acre is 30,000,000

*Total value of Agricultural capital invested in lands, and sheep, and feeding the manufacturers of wool** . $206,000,000

The annual value accruing to agriculture, created by the growing and manufacturing of wool may be thus stated:

Twenty millions of sheep will produce fifty millions of pounds of wool, which, at 35 cents the pound, is . . . $17,500,000

Provisions for the support of the manufacturers of wool as above stated, are valued at 3,750,000

Timber, fuel, teazles, hay, oats, &c. &c. say . . 500,000

The manufacturers of wool have invested in lands, water power, buildings, machinery, &c., with their floating capital, to manufacture the fifty millions of pounds of wool, about $50,000 for every 100,000 lbs of wool, making the manufacturer's investment, $25,000,000.

Statistical Table showing the aggregate amount of Manufactures of Wool in the United States.

	No. Fulling Mills.	No. Woollen Manufact'es	Val. manu-fact'd goods.	No. persons employed.	Capital Invested.
Maine	151	24	$412,366	532	$316,105
New Hampshire	152	66	795,784	893	740,345
Massachusetts	287	144	7,082,898	5,076	4,179,850
Rhode Island	45	41	842,172	961	685,350
Connecticut	157	119	2,494,313	2,356	1,931,335
Vermont	239	95	1,331,953	1,450	1,406,950
Total	1,031	489	12,959.486	11,268	9,259,935
NORTHERN MIDDLE STATES.					
New-York	890	323	3,537,337	4,636	3,469,349
New-Jersey	49	31	440,710	427	314,650
Pennsylvania	346	235	2,319,061	2,930	1,510,546
Total	1,285	589	6,297,108	7,993	5,294,545

* According to the best calculation there are 34,000,000 sheep in the Union. This is an increase of about 5,000,000 within the three last years. These are worth at a fair calculation, $70,000,000. About one fifth of all these are found in the single state of New-York. These sheep, at three sheep to the acre, would require 11,000,000 acres for their keeping, which, worth say twelve dollars per acre, making the amount of $132,000,000 invested in lands.

The aggregate amount invested in sheep husbandry in the United States would therefore be—

In Sheep $68,000,000
In Land $32,000,000

$100,000,000

The annual crop of wool is estimated at 90,000,000 lbs. and worth nearly $40,000,000.

(Table Continued.)

	No. Fulling Mills.	No. Woollen Manfact'es.	Val. manufact'd goods.	No. persons employed.	Capital Invested.
SOUTHERN MIDDLE STATES.					
Delaware	3	2	$104,700	83	$107,090
Maryland	39	29	235,900	388	117,630
Virginia	47	41	147,792	222	112,350
North Carolina	1	3	3,900	4	9,800
Total	90	75	492,292	697	346,870
COTTON GROWING STATES.					
South Carolina		3	1,000	6	4,300
Georgia		1	3,000	10	2,000
Tennessee	4	26	14,290	45	25,600
Total	4	30	18,290	61	31,900
WESTERN STATES.					
Kentucky	5	40	151.246	200	138,000
Ohio	206	130	685,757	935	537,985
Indiana	24	37	58,867	103	77,954
Illinois	4	16	9.540	34	26,205
Missouri		9	13,750	13	5,100
Arkansas		1	129	1	12,600
Michigan	16	4	9,734	37	34,120
Iowa			800		
Total	255	237	929,823	1,323	831,964

Statistical Table, showing the aggregate amount of Machinery manufactured in the United States.

	Val. of machinery manufactured.	No. of men employed.
EASTERN STATES.		
Maine	$69,752	339
New Hampshire	106,814	191
Massachusetts	926,975	913
Rhode Island	437,100	534
Connecticut	319,680	335
Vermont	101,354	87
	$1,961,675	2,399
NORTHERN MIDDLE STATES.		
New York	$2,895,517	3,631
New Jersey	755,050	932
Pennsylvania	1,998,152	1,973
	5,648,719	6,536
SOUTHERN MIDDLE STATES.		
Delaware	314,500	299
Maryland	348,165	723
Virginia	429,858	445
North Carolina	43,285	89
	1,135,808	1,556

Table Continued.

	Val. of machinery manufactured.	No. of men employed.
SOUTHERN STATES.		
South Carolina	$65,561	127
Georgia	131,238	184
Alabama	131,825	96
Mississippi	242,225	274
Louisiana	5,000	
Tennessee	257,704	266
	$833,553	947
WESTERN STATES.		
Kentucky	$46,074	149
Ohio	875,731	858
Indiana	123,808	120
Illinois	37,720	71
Missouri	190,412	191
Arkansas	14,065	51
Michigan	47,000	67
Florida	5,000	8
Wisconsin	716	6
Iowa	. .	. .
District of Columbia	60,300	42
	$1,400,826	1,563

We make the following extracts from a Report furnished by the Hon. H. L. Ellsworth, Commissioner of Patents at Washington, as showing the condition and prospects of that establishment.

PATENT OFFICE, January, 1843.

"In compliance with the law of Congress, the Commissioner of Patents has the honour to submit his annual report.

Five hundred and seventeen patents have been issued during the year 1842, including *thirteen* re-issues, and *fifteen* additional improvements to former patents.

During the same period, three hundred and fifty two patents have expired.

The application for patents during the year past amount to *seven hundred and sixty-one*, and the number of caveats filed was *two hundred and ninety one*.

The receipts of the office for 1842 amount to $35,790 96, from which $8,068 95 may be deducted repaid on applications withdrawn.

The ordinary expenses of the Patent Office for the past year, including payments for the library and for agricultural statistics, have been $22,154 48, leaving a net balance of $5,264 20, to be credited to the patent fund.

The above expenditures do not include those incurred within the last year, for the recovery of the stolen jewels.

For the restoration of models, records, and drawings, under the act of March 3, 1837, $14,060 02 have been expended.

The whole number of patents issued by the United States, previous to January, 1843, was *twelve thousand nine hundred and ninety-two*."

Statements of receipts for patents, caveats, disclaimers, improvements, and certified copies, in the year 1842.

Amount received for patents, caveats, &c.	$35,790 96	
Amount received for office fees.	714 67	
		$36,505 63
Deduct, repaid on withdrawals.	. .	8,086 95
		$28,418 68

Statement of expenditures and payments made from the patent fund, by H. L. Ellsworth, Commissioner, from the 1*st of January, to the* 31*st of December,* 1842, *inclusive, under the act of March* 3, 1839.

For salaries	$16,350 00	
For contingent expenses*	3,687 61	
For library	105 37	
For temporary clerks	2,830 75	
For Agricultural statistics, &c.	105 75	
For compensation to the Chief Justice of the District of Columbia	75 00	
		$23,154 48
Leaving a net balance to the credit of the patent fund	. .	$5,264,20

* Expenses incurred recovering jewels not included.

The applications for patents during the year 1843 amount to 819, and the number of caveats filed was 315.

The receipts of the office amounted to $35,315 81. The profits of the office for the year amounts to $4,538 85.

The whole number of patents issued by the United States up to January 1844 was 13,523. The patents granted for the year it will be seen, have exceeded those of the previous year by 24; and the excess of applications has amounted to 58. In regard to the procuring of patents in the United States, we should remind our British friends that the fee from a native of that glorious *Republic* is $30, and from a Barbarian $500! This does not include models, drawings, specifications, &c., &c., &c.

THE SILK CULTURE.

It is astonishing what rapid strides this interesting branch of industry is making in the United States: indeed we would not be at all surprised if in the course of a few years, these Americans manufactured sufficient silk goods of every description to supply not only the home consumption, but the whole world. One thing is quite evident, the day is not far distant when our British manufacturers will have to seek a market for their goods elsewhere than in Yankee Land.

As an evidence showing the attention which is paid to this subject in that country, we make the following extracts from a report of the select committee on the subject of Silk Culture to the Legislature of the State of Ohio, Feb. 24th 1842:—

"Your Committee report that the *wealth* of a country is the product of the labour of that country. Individuals may become wealthy by speculation, and by various means other than by labour; but all that is obtained in this way by one, is *taken from the pockets of others*, and there is no increase in the ag-

gregate. But the *labour* of a community will *produce* something *valuable* as its necessary result: that is, of course, when the labour performed has that for its object. The wealth of a country will increase in proportion as the products of its labour increase. Every man can, by his labour, *produce* something; and every additional amount of labour, when rightly directed will give an additional product. To this product will be attached a certain *value;* and it follows that every product obtained from the additional LABOUR of the country, must add something to the aggregate wealth of the country. There can be no doubt but a large amount of the raw material of silk may be *produced* in this country by labour that in any other business would be unproductive. Most of the labour can be performed by aged persons, children and females, who, without this employment would produce little or nothing. In fact, the aged and the children would be a tax upon community to the amount of the cost of their support. There are in the state of Ohio 1,500,000 inhabitants. Supposing that, on an average, that each family consists of *five* members, there are 300,000 families in the State. Reducing this again to one fifth, would leave 60,000. Does any person doubt but there are 60,000 families in the State of Ohio that can produce, each, ten pounds of raw silk every year, without the cost of any additional labor? It can be produced mostly by labour that would otherwise be unproductive. On this supposition, the product of the 60,000 families would be 600,000 pounds of raw silk. This, at $5 a pound, would be a product of $3,000,000 to the people of the State. But, while there are 60,000 that can produce ten pounds each, there are one half that number that can produce twice that amount. This would give an additional amount of 300,000 pounds, worth $1,500,000; in all a product worth $5,500,000 to the public. This could be done, and the products of the State in every *other* particular, be as large as they now are. This would as really be an addition to the wealth of the State as though the amount were *coined* expressly for her benefit. It is the product of labour otherwise unproductive, and so much clear benefit to the people.

"But look at the same calculation for the whole Union. We have 15,000,000 of people. One fifth of that number is 3,000,000, and one fifth of that number is 600,000. A product of ten pounds, each, would be 6,000,000 pounds; at $5 per pound, it would be $30,000,000. This is the raw material; and this is made without any reference to the vast numbers who will make the silk culture their business, and who will consequently produce a much larger amount.

"But farther—the following is a statement of our exports and imports, from 1833 to 1840, inclusive.

1833	$90,140,433	$108,118,311
1834	104,336,933	126,521,332
1835	121,793,577	149,894,742
1836	128,773,040	189,980,035
1837	118,419,376	110,980,177
1838	108,486,616	113,717,404
1839	121,028,416	162,092,132
1840	131,581,950	104,804,861
Total	$924,560,341	$1,066,108,994

"It will be seen that the balance against us, in the eight years, is *one hundred and forty-one millions* 548 *thousand six hundred and fifty three dollars.* To this enormous extent, there was a debt created against us. We *bought* more than we *sold.* And to pay this debt the precious metals were taken out of the country, and the necessary result was pecuniary embarrassment. This will always, necessarily, be the case, when we send our money out of the country, whether for the purchase of goods, or for any other purpose; as long as we can pay for what we buy with our own products, our money remains with us, and is used as a circulating medium. The only remedy for the evil is, either to *buy less* or to *sell more,* or, perhaps both. The excess against us, caused by the excess of our imports over our exports, for eight years is, as is above stated. From 1835 to 1840, inclusive, the balance

against us was $132,607,723; and during the same period we imported silk to the amount of $105,992,190, or nearly $18,000,000, per annum. We have paid so much for silks which we might as well have produced ourselves. The money so paid is a loss to the country. In 1839 we purchased of other countries, silk to the amount of nearly $23,000,000, as follows:

Silks from India and China, piece goods	$1,738,509
" " sewings	50,650
" sewings from other places	78,884
" raw silk	39,258
" from other places than India, veils, shawls, &c.	345,490
" other manufact. from other places than India	18,685,295
Manufactures of silk and worsted $2,319,884, (allowing one half the value to be silk,)	1,159,942
Total	$22,098,028

" The importations of silk are one-fourth more than of any other article.

The amount of cotton manufact's imported, was	$14,692,397
Of iron	12,051,668
Of cloths and cassimeres	7,025,898
Other woollen manufactures	3,507,161
One half the value of silks and worsteds	1,159,942
Total woollen goods	18,831,907

" The amount of silk nearly equals that of woollen and linen together, and is equal to one half of all other fabrics combined. Is it not then an important consideration, that this expenditure be saved to the nation! Abstract the article of silk from the catalogue of imports, and our indebtedness would be trifling. But in addition to the debt incurred by our annual purchase, there is the interest on the loans made by the States, of $12,000,000 a year to be met, and an enormous debt of $200,000,000, being the loans themselves that must be paid some how or other. How can it be done? *It can, every cent of it be paid, by our exports of silk.* After raising enough for home consumption, the world is then open to receive all that we can produce.

" In England the importation of raw silk, from the year 1821, to 1828, was 24,157,568 lbs.; which, when manufactured, was worth £120,770,580 sterling; and the hands required for its manufacture were more than 400,000. This sum is equal to $536,222,237! or $76,190,462 each year. Of this amount, Italy alone furnished $59,881,233. In 1835, Great Britain consumed, at wholesale prices, to the value of $28,282,582 of manufactured silks. The sum paid to weavers alone, not taking into account what was paid for throwsting, winders, doublers, drawers, warpers, the soap, the dye-stuffs, and the various mechanics, was little short of $14,000,000; the amount of silk goods now produced in that kingdom, is stated to be *seventy five millions of dollars!* But they raise not a pound of the *raw material.*

"France manufactures $28,000,000 of silk, and imports of the raw material from eight to ten millions of dollars worth. She could manufacture annually $50,000,000 worth, could she procure it. England and France in common with all civilized nations, are competitors for this precious material, wherever found; but especially Germany, Prussia and Russia would enter the field, making annual demands upon us, could we supply them, for from 200 to 250,000,000 lbs.!"

The art of weaving, as we before observed, naturally divides itself into a great number of separate or distinct branches, differing so materially that an experienced manufacturer, or workman in one of them, is often nearly as much a stranger to some of the others, as a person entirely ignorant of weaving. While at the same time, the constant demand for novelty and variety, to give life and vigour to our commerce, and to enable us to maintain competition with foreigners, renders a complete knowledge of the art of the utmost importance, both to the manufacturer and the operative tradesman. From this consideration the present work was first undertaken, and how far it may be found to answer this important end, time, and an enlightened public only can determine.

SECTION FIRST.

PLAIN WEAVING.

WINDING OR SPOOLING.

The common custom of spinners is, to reel the yarn into hanks, or skeins of a given length, and in this state, to deliver it for the purpose of being made into cloth.

This process does not come within the compass of the present section; although the arts of spinning and weaving, which form the two great divisions of labour in manufacturing cloth from the raw material, are so intimately blended, that hardly any thing analogous to the one art, is entirely foreign to the other. At present it will be sufficient to consider yarn in the hank state.

The first process in linen and cotton yarn, is boiling in the hank. The fibres of the former, being long and tenacious, require only to be freed from impurities by means of boiling water, and soap or potash. To the latter a certain proportion of flour is added, to increase its firmness. When these operations have been performed, and the yarn has been thoroughly dried, it is wound upon bobbins, commonly called spools. This is done, generally for hand looms, by means of the common bobbin wheel, and swifts or runners, which are so well known that we think it unnecessary to give drawings of them.

WARPING.

The warping mill forms a circle, or rather a polygon inscribed within a circle, and the yarn is wound around it in the form of a spiral or screw, by which means a very great length may be produced in a small compass. Warping mills, for hand looms, are constructed of different heights and circumferences, according to the particular species of goods for which they are designed, or the

room which they are to occupy. A plan and elevation of those used in the manufacture of silk, cotton, and other goods will sufficiently illustrate the principle of their construction, and these will be found in figs. 3, 4. and 5.

Figs 3 and 5.

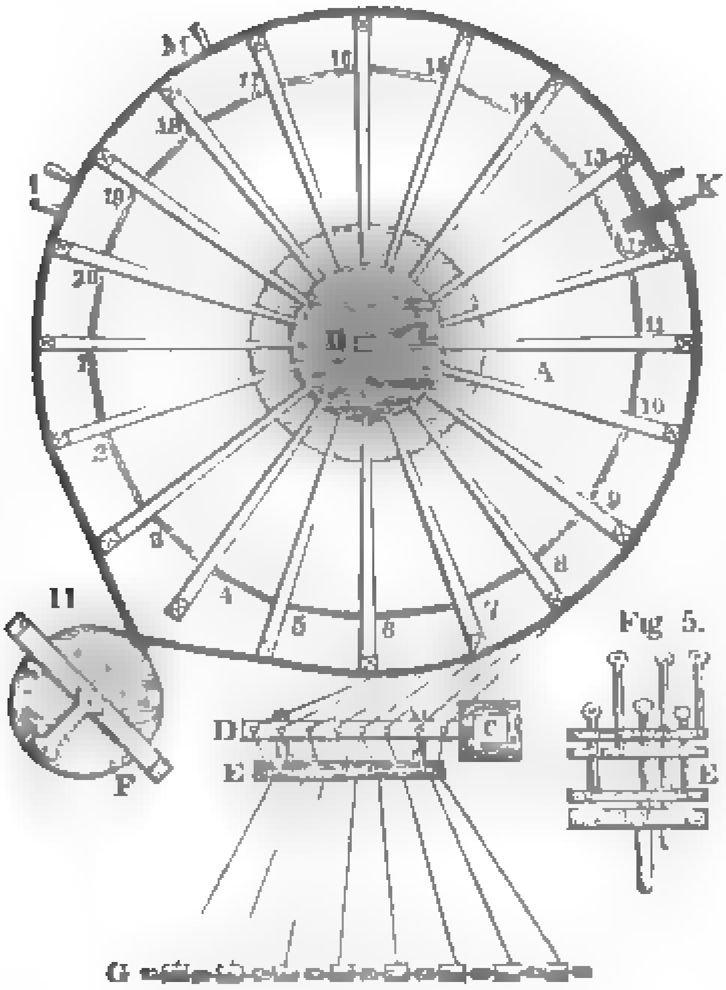
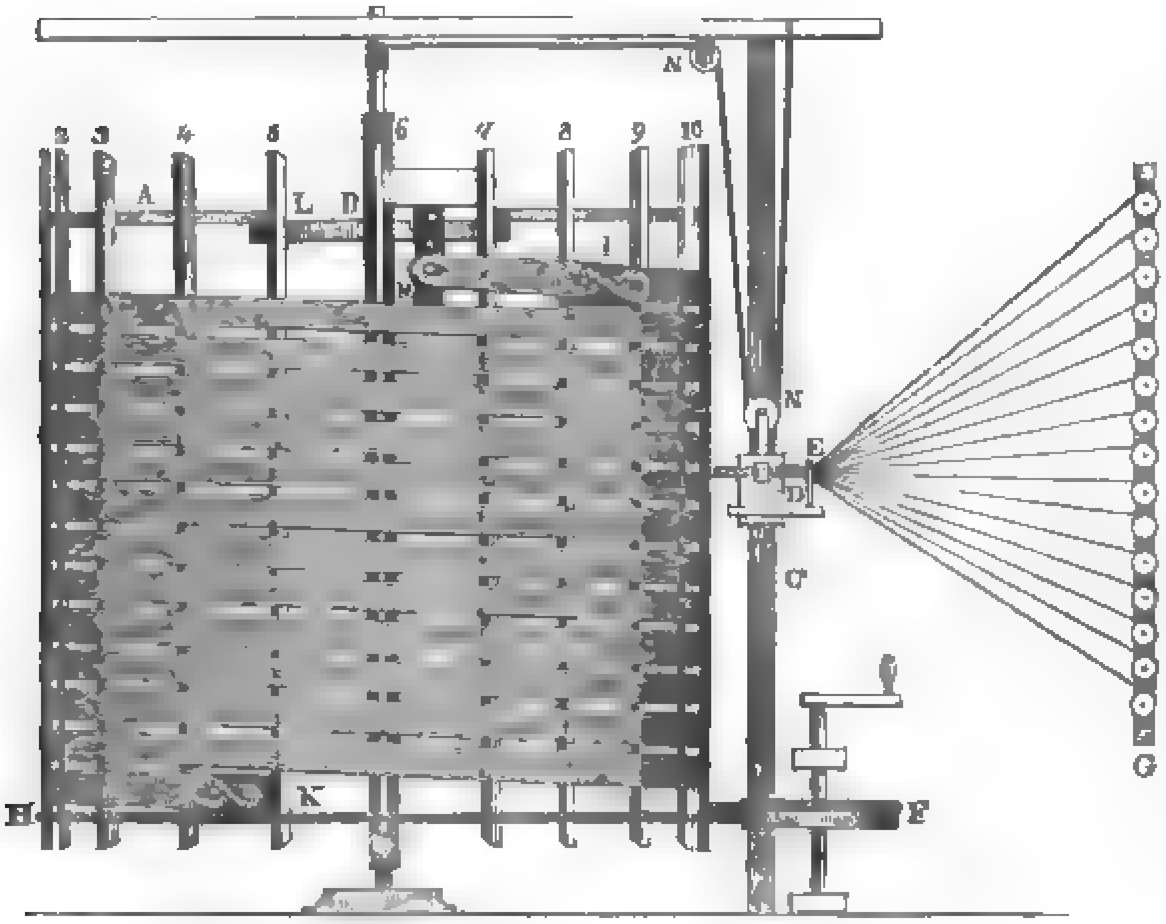


Fig. 3 is a ground plan and Fig. 4 a profile elevation, and the same letters refer to corresponding parts in both figures. The circumference of a mill is generally five English ells of 45 inches each, and is divided into 20 equal parts of $11\frac{1}{4}$ inches or $\frac{1}{4}$ of an ell to each. The mill is built upon three horizontal frames, one of which is represented at A Fig. 3. The circular piece L is of solid wood with a mortise B in the centre, having a square axis passing through it, in each end of which axis is an iron pivot or journal. The lower pivot works in a socket and the upper in a round hole or bush, the axis being placed perpendicular to the horizon. The mill is turned about by a trundle F, from which motion is communicated to it by a crossed band H, passing around its circumference, as near to the floor as convenient. The arms or radii (20 in number) are dovetailed into grooves in the centre piece L, and their extremities are mortised into the upright standards which form the circumference of the mill, and which being exactly $11\frac{1}{4}$ inches

asunder, from centre to centre, divide that circumference into 20 equal parts. The arms are numbered from 1 to 20, and appear very plainly in Fig. 3; but the standards at their extremities appear only as sections.

Fig. 4.



In Fig. 4 nine of the upright standards are quite visible, and are numbered from 2 to 10. Near the circumference the arms are connected and kept firm by round pieces of wood, as represented in Fig. 3.

E is the *heck*, as it is usually called. It consists of a number (120, or more,) of steel pins, with a round hole or eye in the upper end of each, through which a thread passes in the process of warping. The pins are placed alternately in two frames, distinct from each other, and either of them may be raised at pleasure. By these means what is called the lease is formed, and it is most essential in every stage of the operation of weaving, as the whole regularity of the yarn in the loom depends upon it. Fig. 5 is a front elevation of a part of a heck, for the purpose of showing more distinctly the way of lifting the alternate threads, when required. The steel pins of the heck ought to be very carefully polished for the sake of smoothness, and should be tempered hard, to preserve the eyes from being worn by the friction of the threads passing through them.

D is a frame of wood, on the upper part of which are fixed a convenient number of pins, in a perpendicular direction, and at equal distances. Upon each of these is a small pulley of hard wood, which runs freely round. These serve to guide the yarn upon the mill, and also to divide it into portions called *half gangs* or *bouts*, which are useful in the subsequent operation of *beaming*, as will be hereafter described. On the end of the frame D is a square box, through which a perpendicular post C passes, and upon it the whole frame D slides up or down, when the mill is set in motion. This is effected by means of a cord passing over the pulleys NN, Fig. 4, and fixed to the end of the axis of the mill.

When the mill is turned one way, the cord winds around the axis and raises the frame D; when turned the contrary way, the cord unwinds and the frame is lowered. Four small rollers are generally placed in the inside of the box to diminish the friction of the post C. G. Fig. 3, is a horizontal section of the frame for containing the bobbins, or as it is commonly called the *bank*.

Two cross pieces of wood, I and K, pass between the upright standards which form the circumference of the mill; in each of them are too smooth round pins, on which the leases are formed. Near to the upper lease pins I, is another pin M, and upon this the warp is turned. The cross piece I is fastened to the mill, but that at K is moveable.

OPERATION OF WARPING.

The number of bobbins which are to form the warp are placed in the frame or bank G, so that the threads may unwind from the upper part of them; the threads are then passed successively, through the eyes of the heck E, and the whole being knotted together are fixed to the pin M, upon the mill, (see Fig. 3.) The mill is then turned slowly, until the top lease pins at I, come nearly opposite the heck. The warper then, lifting half of the frame or thread guide, passes the forefinger of his left hand through the space formed between the threads which are raised and those that remain stationary; he then sinks the frame which had been lifted, to its former place, and lifts the other. (One half of the threads in the gang or bout passes through each of these guides.)

Into the space formed by this he inserts his thumb, and carefully places the yarn upon the two pins at I, the first passing through the interval kept by his fingers, and the second through that kept by his thumb. Every alternate thread is thus crossed and the lease

is formed. He now divides his yarn into portions, as nearly as possible equal to each other, to form half gangs. These are kept separate by passing along different rollers on the frame D, (see Fig. 3,) until he arrives at the lowest lease pins K. Turning the mill gradually and regularly round, he winds the yarn about it in a *spiral*, formed by the descent of the frame D, until he has completed a number of revolutions sufficient to produce the length of the web, and then fixes the lower pins at the proper place. Upon these he turns his warp, forming another lease, by passing every division, or half gang of his yarn, alternately, over and under each pin. This lease differs from that formed upon the upper pins only in this respect, that instead of being formed by the crossing of the individual threads, it is produced by crossing the half gangs, and is used, as formerly stated, in order to preserve regularity in the operation of beaming. The lower lease being now formed, the warper turns the mill in a contrary direction until he arrives again at the top, and repeats the former process till he has collected upon the mill the quantity of warp required in the web. As soon as this has been effected, he secures his leases, by tying round one half of the yarn upon each pin, cuts away his threads, and drawing the warp gradually off the mill, links it into a succession of loops called a *chain*, forms it into a bunch, or ball, and in this state it is delivered to the weaver.

In this consists the whole operation of warping. It is an important part of the duty of a warper to be very careful that any threads which may be broken in the process, be immediately tied, that they may not be crossed over the others.

We shall now proceed to the next operation, which is Beaming.

BEAMING.

When the weaver has received his warp, his first care is to wind it upon the beam in a proper manner.

Having ascertained the number of half gangs, and the breadth of the web, he passes a small shaft through that formed by the first. This gives him the lease for beaming, and keeps the half gangs distinct. An instrument or utensil called a *ravel* is then to be used. We have not given any figure of this because it differs in nothing from a *reed*, excepting that the intervals are much wider, and that the upper part may be taken off, for the purpose of putting the half gangs in their respective places.

Ravels, like reeds, are of different dimensions, and one proper for

the purpose being found, every half gang is to be placed in an interval between two of the pins.

The upper part or *cape*, is then put on and secured, and the operation of winding the warp upon the beam commences.

Two persons are employed to hold the ravel which serves to guide the warp, and to spread it regularly upon the beam ; one, or two to hold the chain, or chains of the warp, (there is often more than one chain in the web.) at a proper degree of tension, and one, or more to turn the beam.

DRAWING OR ENTERING.

Two rods are now inserted into the lease formed by the upper pins on the warping mill, and the ends of these rods are tied together, the warp being spread out to its proper breadth. The beam is then suspended, by cords behind the headles, sufficiently elevated to be out of the way of the person who hands in the threads to the weaver, the warp hanging down perpendicularly. The weaver opens every headle in succession, and it is the business of the other person to select the threads in their order, and deliver them to be drawn through the open headle, or headles. The succession in which the threads are to be delivered is easily ascertained by the rods, as every thread crosses that next to it. The warp, after passing through the headles, is next drawn through the reed by an instrument called a *reed hook* or *sley hook*, two threads (for plain cloth) being generally taken through every interval.

These operations being finished, the *cords* or *mounting*, which moves the headles, are applied, the reed is placed in the lay, and the warp is divided into small portions, which are tied to a shaft connected by cords to the cloth beam. The weaver then dresses or sizes a portion of his warp and commences the operation of weaving. But before entering into the investigation of this process, it may be proper to devote some attention to the construction of the loom.

The most essential working parts of this machine are represented in Figs. 6 and 7.

Fig. 6.

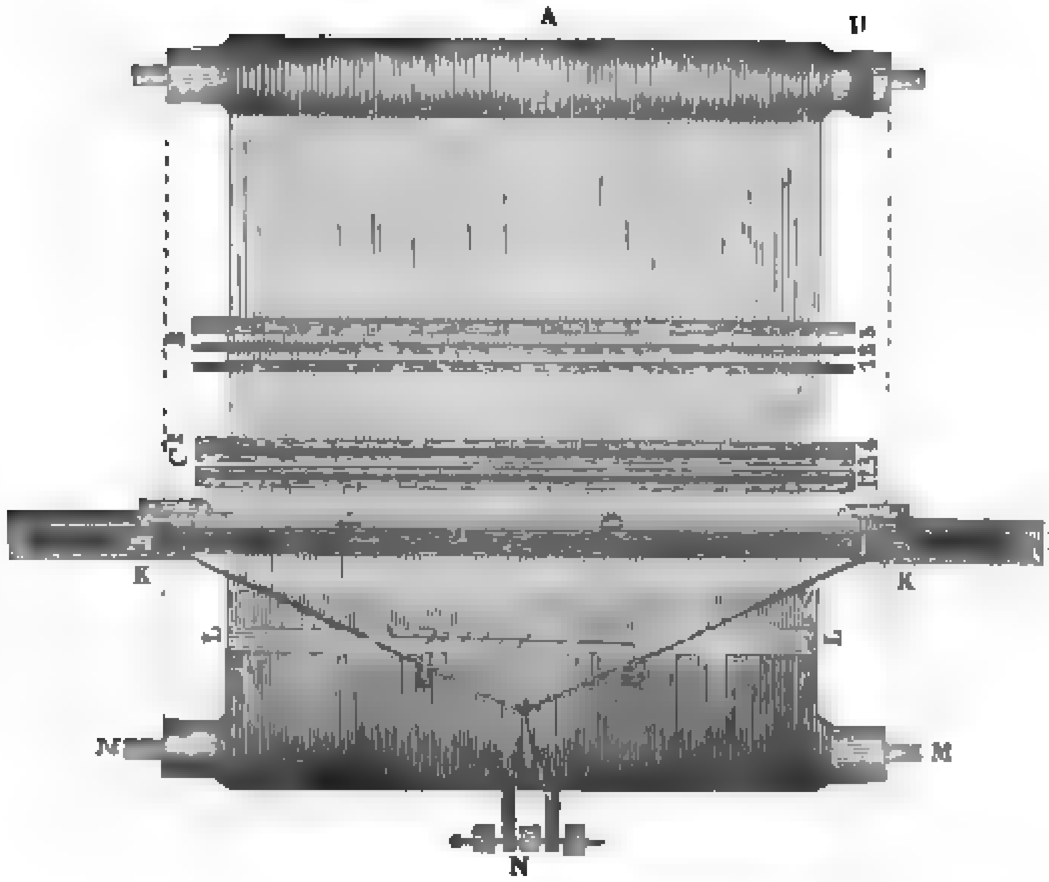


Fig. 6 is a ground plan, or rather a horizontal section of a common loom, parts of which are cut away, for the purpose of showing in their proper forms other parts of the loom, warp, and cloth, as they could not be otherwise represented.

Fig. 7.

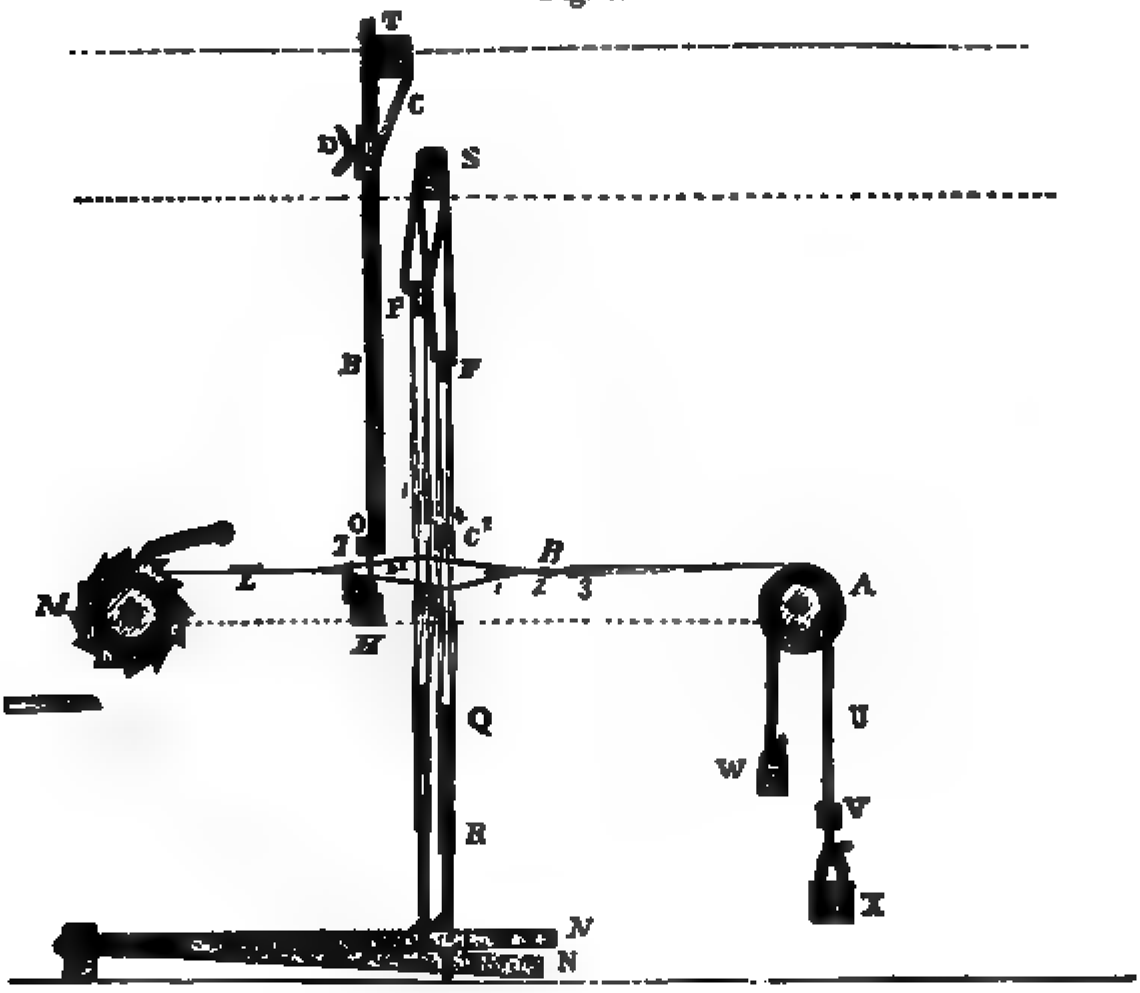


Fig. 7, may be considered either as a profile elevation, or
profile section of the same loom.

All the parts in Fig. 7, are represented as they appear to a p
standing at one side of the loom, and many parts, concealed
away in Fig. 6, are seen very plainly in Fig. 7, whilst many
which are distinctly seen in Fig, 6, are, of necessity, either pa
or totally hid in Fig. 7.

Fig 8.

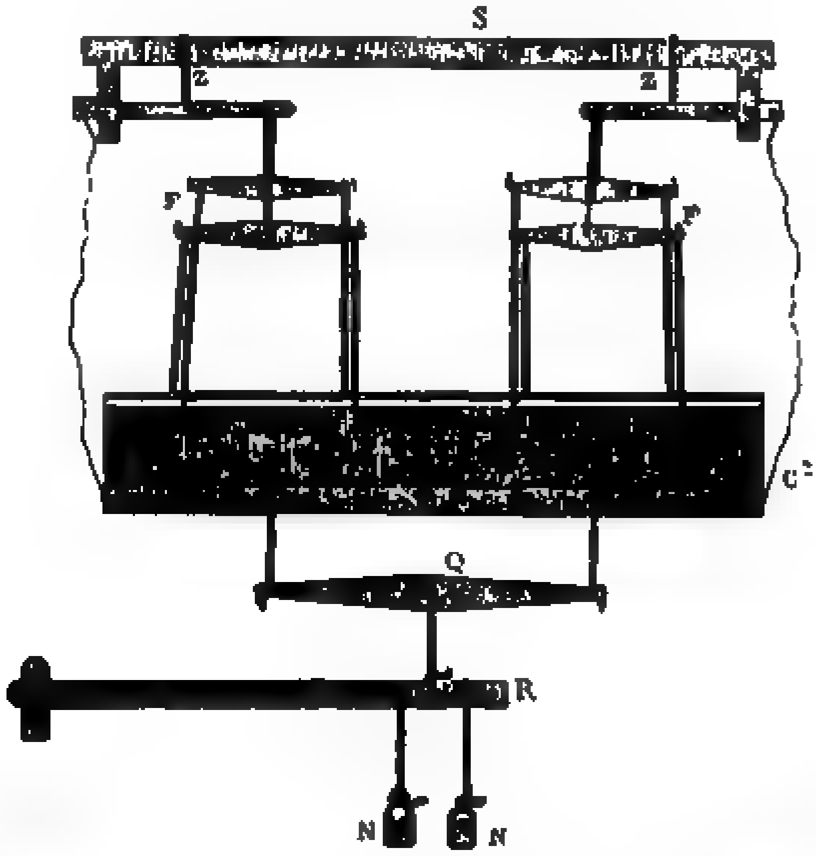


Fig 9

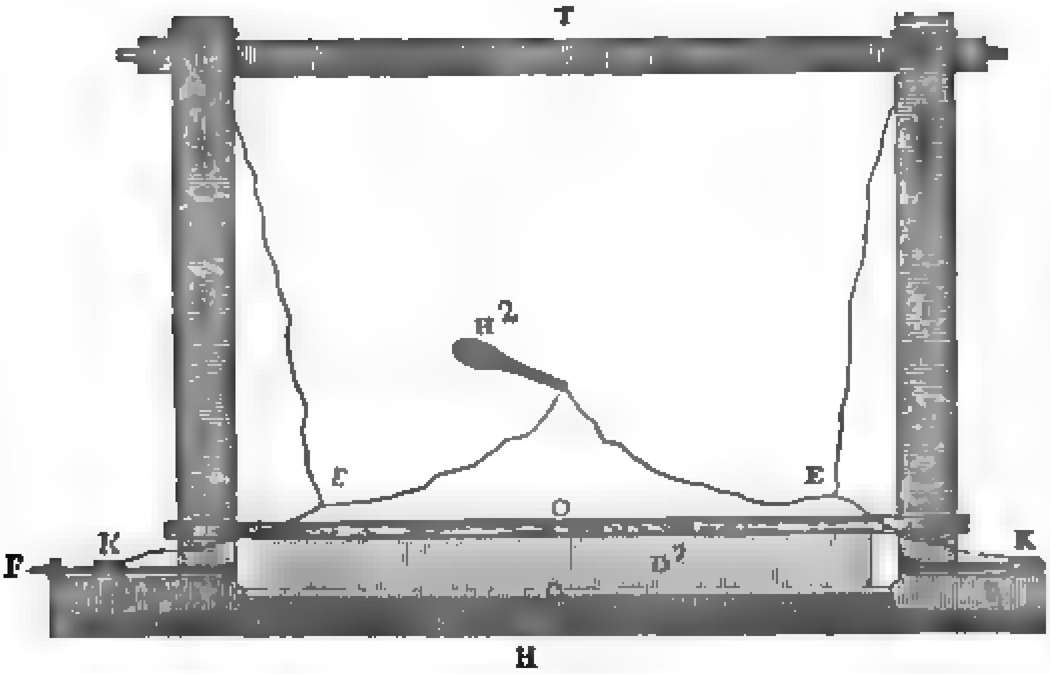


Fig. 8, is a transverse section of the same loom, as viewe
the front; the cloth roll, the lay, and all the other parts in fr

the heddles, are taken away that the mounting contained in the figure may be seen. The lay and reed, which are left out of Fig. 8, are distinctly represented in Fig. 9. In all these figures the same parts of the loom are marked by the same letters, and thus by comparing the figures, every part is shown in the various forms, in which it would appear when viewed above, in front, or at one side.

It has been deemed best, totally to omit the side and cross frame work, and to exhibit only the *working* or *moving parts*. This has been done for two reasons.

First, Because the construction of the frames of looms are very different, and the particular form, is not often essential to the operation, but may be varied according to the fancy either of the weaver or loom maker,

The dimensions also vary according to the nature and breadth of the work for which the loom is intended.

The strength of the different parts must depend entirely upon the work to be performed; for it will be obvious, that the quantity of wood necessary to give sufficient strength to the posts and rails of a sail cloth or a sheeting loom would prove a useless encumbrance, and add an unnecessary weight to one designed for weaving light fabrics of silk or muslin.

It is sufficient therefore, in constructing the frame work, that care should be taken to make it of strength equivalent to the stress of the work which is to be performed, that the parts should be accurately squared, the joints tight and firm, and that the frame should be well fitted to the working parts. If these points are sufficiently attained the most simple and least expensive plan of construction must in this, as in all other machinery, prove invariably the best. The second reason for omitting the frame work is, that it would have been difficult to represent the working parts distinctly without many additional drawings, because, in most instances, many things would have been concealed by the intervention of different parts of the frame, which will prevent unskillful persons from properly understanding it.

The following are the principal working parts of the common loom: A, Fig. 6, the yarn beam, B the rods which keep the threads of the warp in their respective places. The rods pass through the intervals which form the lease, that is to say, a thread passes *over* the first rod, and *under* the second: the next passes *under* the first and *over* the second, and so on alternately.

By this contrivance every thread is kept distinct from that on

either side of it, and if broken, its true situation in the warp may be easily and quickly found. This is of such importance that too much care cannot be taken to preserve the accuracy of the lease. The third rod divides the warp into what is usually called *dentfuls* or *splitfuls*, for two threads pass through the same interval betwixt the dents of the reed : a close inspection of the lines which represent the threads of the warp in Fig. 6, will serve to illustrate this, for the lines are drawn so as to show the way in which each thread passes between the rods. The third rod is commonly, although improperly, called the *lease rod*, for all the rods are lease rods, and the preservation of the lease is the chief cause of using them. C^2, the headles through which the warp passes, and which by raising and sinking one half of the warp alternately, form the spaces or sheds to receive the weft. D^2 the reed through which also the warp passes, (two threads being drawn through every interval,) and which, moving along with the lay, strikes home the weft to form the cloth, H, the lay, (see Figs. 6 and 9,) mentioned above, vibrating on centres, placed upon the upper rail or cape of the loom. I I are the boxes for receiving the fly shuttle, and KK the drivers for giving motion to it : LL, the temples for stretching the cloth to a proper breadth, and MM is the cloth beam for receiving the cloth when woven.

Below the headles, and attached to them by cords, are two treadles NN, (see Fig. 7,) which are moved by the weaver's feet to open the sheds. The shuttle is driven through the shed by a motion communicated by the weaver's right hand, the lay being moved backward and forward by his left.

Before proceeding further, it may be proper to notice, briefly, the different parts of the loom in succession, to explain the nature of their construction, and their application to the purposes for which they are intended.

YARN ROLL OR BEAM.

In constructing this part of the apparatus particular care should be taken to select wood, perfectly sound, and thoroughly seasoned. Whilst the least moisture remains in the wood no operation performed upon it can be trusted. But it is absolutely necessary that the yarn beam of a loom should be, as nearly as possible, both perfectly straight and round. In proportion to any deviation from these, the loom will be defective, and the deficiency will prove injurious in proportion to the fineness of the cloth to be woven. It is therefore of the utmost consequence that the wood should be dry, and the

iron axles driven into it before the beam is turned, and that the turner should be very careful in the execution of this part of the work.

Upon this depends, in a great measure, the uniform tightness of the warp, and, of course, the beauty of the cloth. It is, besides, of the first consequence to the operative weaver, because, if the beam bends by twisting, one side will be heavier than the other, and oppose greater resistance to the threads of the warp, which may cause many of them to be broken. This greatly retards the work; for every operative weaver will be convinced, that he may throw many picks of weft sooner than he can tie one thread of warp.

The warp is kept in a proper degree of tightness by means of a cord U, (see Fig. 7,) rolled two or three times round one end of the yarn beam.

One end of this cord is fixed to a lever V. This lever, the end of which only can be seen in Fig. 7, and which does not appear at all in Fig. 6, is parallel to the beam, and directly under the back part of it, so that the cord passing from the lever to the beam, may be in a perpendicular direction. To the other end of the cord, after passing round the beam, is fixed a weight W. A heavier weight X is then hung from the lever V, and as this weight is moved nearer to, or further from the fulcrum of the lever, the tension of the warp will be increased or diminished. This apparatus is called a *pace*.

In heavy fabrics, it is still the custom, in hand-loom weaving, to tighten the warp by means of a stout pin, which is called a *bore staff*. The yarn beam of looms constructed for heavy work, seldom has iron axles, but is merely rounded at each end; and at the right hand side a number of holes, say six, are bored, and into one of them, one end of the bore staff is inserted, the other being drawn upwards by a cord, until the warp is sufficiently tight.

RODS.

As mentioned before, the principal use of the rods is to preserve the lease. When any threads of the warp are broken, great care ought to be taken to have them returned into their proper places. When this is neglected, the warp gets into confusion, and great trouble, and loss of time ensue. The rods are made of hard wood, and should be well smoothed, to prevent them from catching, or breaking the warp: the two front ones are of a circular form, the third or lease rod is flat, and broader than the others, which is convenient in the process of dressing the warp, as will be afterwards

described. The rods are kept at a uniform distance from the headles,* either by tying them together, or by a small cord with a hook at one end, which lays hold of the front rod, and a weight at the other, that hangs over the yarn beam.

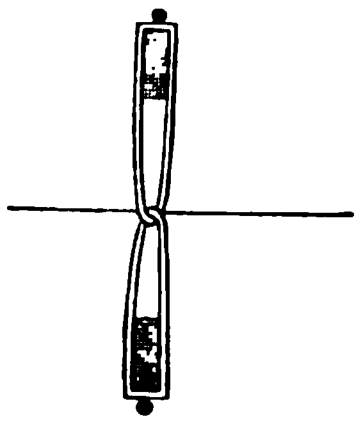
HEADLES.

To weave plain cloth, only two leaves of headles are really necessary, but in fine webs, where many threads are contained in the warp, the number of headles required would be so great, that they would be crowded too much together, which would cause unnecessary friction, and strain the warp. For this reason four leaves are now universally employed, except in very coarse work; they are made of stout smooth twine, composed of 9 strands, and are connected together by cords above and below, to which each headle leaf is fastened. They are then stretched on two thin flat shafts of wood.

The upper edges of these four shafts are represented in Fig. 6, at C , and the sections or ends of them at C^2, Fig. 7, where the front leaves appear raised, and the back ones sunk for opening the shed, through which the shuttle passes.

For plain work clasped headles are chiefly used; a representation of which, upon a large scale, is shown in Fig. 10,

Fig. 10.

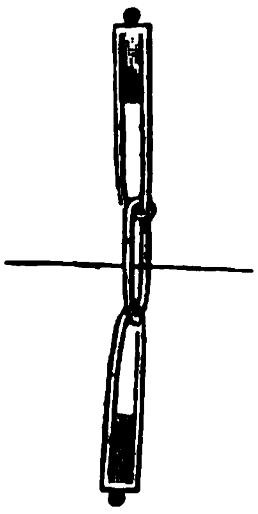


where the headle twine is represented by double lines, for the purpose of showing how the upper and lower parts cross each other. The cross line shows the direction in which every thread of the warp passes through the headle. For many kinds of work, the headles are constructed with eyes, one of these is shown in Fig. 11,

* The Irish linen weavers always have the front rod (or rod No. 1.) from 3½ to 4 inches from the back headle; and in plain cotton goods, the distance at which they are kept separate seldom exceeds 5 inches. The grain of the cloth, we know from experience, is better, when the rods are kept about 4 inches from the back headle, than at a greater distance.

which will also explain, by inspection, the way in which the twine is knotted to form the eye.

Fig. 11.



In Fig. 8, which is an elevated seotion, as seen from the front they are distinctly seen, and the construction of the whole is rendered very apparent. On the upper side rails of the loom rests the headle bearer S, stretching across the loom. From this two levers Z, are suspended by cords; from one end of these levers are hung the jacks F, and from each end of these jacks pass the cords which connect them with the upper headle shafts. The cord connecting one end of each jack with the headles, is attached to the first and second leaf, and that connecting the other end, to the third and fourth leaf. Under the headles are two spring staffs Q, suspended by cords from the under headle shafts. These are connected with the two marches R, which move upon joints, and the marches are again connected with the two treadles, from which the whole motion is derived. The other end of the lever Z is connected by a small cord with the under headle shafts, and this end rests in a small notch, fixed to the side frame of the loom. When the headles are to be pushed back, the levers are relieved from the notches; the weaver then presses down the upper shafts, by means of the small cords, the under shafts are at the same time raised, and thus the headles are slackened to ease the warp. When headles with eyes are used, this apparatus is unnecessary, and the jacks may at once be hung from the headle bearer S, as in Fig. 7. Another way of easing the headles is now most generally practised; the lower links, or *doups*, are lifted by small rods, and the headles are pushed back by moving the lay.

In drawing the warp through the headles, the first thread is taken through the fourth or back leaf, the second through the second, the third through the third, and the fourth through the front. When it becomes necessary in the after process, occasionally, to draw out the rods, their places may be recovered in the following manner:

By raising the third and fourth leaves and sinking the first and second, the place of the second rod is given; and by reversing this, we find that of the first. By raising the first and third leaves and sinking the second and fourth, we obtain the place of the lease rod.

LAY AND REED.

Fig. 9 is an elevation of the lay and reed, taken from the front, and exhibits very plainly those parts which are either concealed, or imperfectly seen in the plan and profile, Figs. 6 and 7. The parts of the lay are as follow: H is the sole or shell of the lay, in which there is a groove to receive the lower edge of the reed D^2; O is the top shell, in which also is a groove, and by these it is kept in its place; BB are the two swords or supports of the lay, which are suspended from the rocking tree T, by means of cords CC, as represented more clearly in Figs. 7 and 9. When the pins at DD are turned round, they twist the suspending cords, which of course, become shorter. By these means either end of the lay may be elevated or depressed at pleasure, to bring it into a proper working position. Instead of these cords, screws are sometimes used, which is certainly a steadier, though a more expensive plan. The boxes I I are constructed of a proper size to receive the fly shuttle, which is driven from either by pulling forward the driver K, sliding freely on the polished spindle F; it then passes along the race G, with great velocity, and lodges in the opposite box.

The drivers are moved by the cords EE, fastened to the handle H^2, which the weaver moves with his right hand, as before mentioned.

In weaving light fabrics of cloth, the upper rib of the reed is not confined in the shell of the lay, but a light shaft of wood with a groove is used. To each end of this shaft is fixed, at right angles, a thin flat piece of wood, which springs easily backward and forward.

The extremities of these pieces are nailed to the back of the swords of the lay, and a cord is tied round both, by which the degree of spring may be regulated, the rib of the reed is received into this groove, and the shell is to be used above the vibrating reed, serving merely as a rest for the weaver's left hand to work the lay.

By this contrivance the reed yields when the weft is driven up, and diminishes the danger of making the cloth too thick. These machines are called *flyers*. In still lighter goods, a woollen cord is stretched between the swords, and to it the upper rib of the reed is tied.

The regularity of the cloth depends much upon the evenness of the dents of the reed, and if this is neglected the warp will be frequently broken, and the texture of the cloth impaired.

The dents ought not to be perfectly flat, but thicker in the middle, and tapering to either edge. This not only diminishes the friction on the warp, but will allow any small knot or lump to pass much easier without breaking the thread.

The fineness, or as it is called among weavers, the *set* of a web, is determined by the number of dents of the reed in a given length. The reed is divided into hundreds, and these again into five parts, each containing twenty dents. A reed for working hollands is considered to be 40 inches in length, for linen 37 inches, and for cambric 34 inches; and the number of hundreds contained in these respective lengths is called the *set*. It is probable that these lengths owed their origin to the breadths of which it was customary to weave these different kinds of cloth.

The 40 and 34 inch reeds are now very little used, and the 37 inch, or linen reed, is universally adopted, at least in the cotton manufacture. The cause of this seems to be founded upon considering a yard of 36 inches as a proper standard, and as most kinds of cloth shrink considerably in the breadth, the additional inch is, no doubt, allowed for this. But the shrinking of cloth is very different in various fabrics. Cloth of a stout, thick texture requires a much greater allowance than light goods. The additional quantity of warp is, therefore, allowed by the manufacturer, in proportion to the quality of the web, and this is regulated by observation and experience.

The length of the Scotch yard is 37 inches, and it *probably* bears this proportion to the English yard of 36 inches for a similar reason. In Lancashire and the adjoining counties, where the manufacture of cotton goods, chiefly thick fabrics, is carried to a very great extent, a mode of counting their reeds, different from any of those above mentioned, is in use.

Their reeds are divided into portions of 19 dents each, which they call *beers*, and the number of these, contained in 24 inches is called the number of the reed.

TEMPLES.

The temples, by which the cloth is kept extended, during the operation of weaving, consist of two pieces of hard wood, with small sharp points in their ends, which lay hold of the edge, or selvage of the cloth at either side.

The pieces are connected by a cord, passing obliquely through holes or notches in each. By this cord they can be lengthened, or shortened, according to the breadth of the web. They are kept flat after the cloth is stretched, by a small bar, turning on a centre. Their form will appear very plainly at L, in Fig. 6; one end is seen at L, Fig. 7.

CLOTH ROLL OR BEAM.

Behind the temples is the roller over which the cloth passes, as fast as woven, (this roller should be well seasoned, and turned very true,) and is then wound on the cloth beam MM. When the warp has been wrought up as near to the headles as can be done conveniently, the weaver shifts forward the temples, rolls up a proper quantity of cloth, which unwinds an equal length of warp, then shifts back the rods and headles, until the latter hang perpendicular, and proceeds with his weaving.

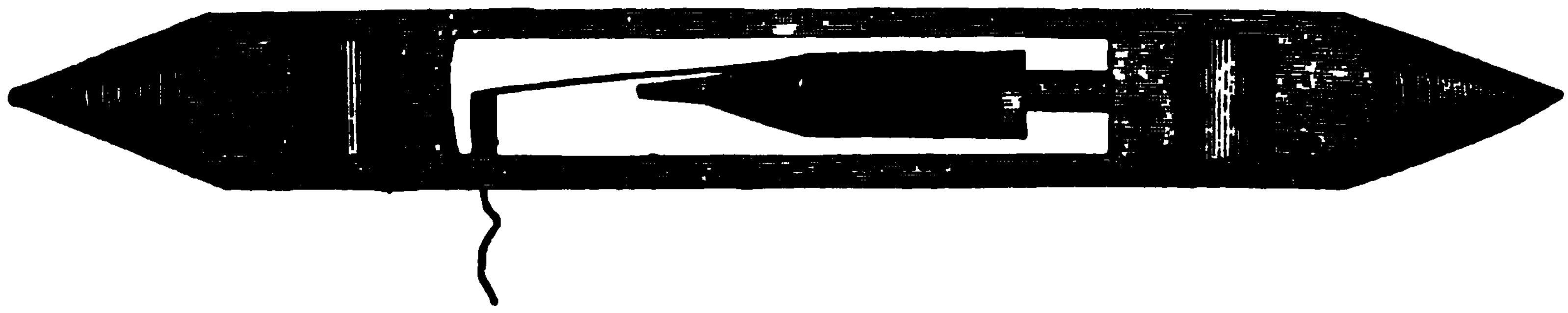
This is called *drawing a bore* by the Scotch, and a *sink*,* by Irish linen weavers.

In weaving thick and bulky fabrics of cloth there is a cross beam of wood called the *breast beam* instead of the small roller.

SHUTTLE AND QUILL.

The shuttle is made of well seasoned *box wood*, or of *apple tree*, and tipped with steel at each end; it runs upon two small wheels of iron, or wood, hung on centres; the weft thread, escaping from the quill, passes through a small eye of glass, or ivory, inserted in the side of the shuttle, next to the cloth. Fig. 12 is a representation of both.

Fig. 12.



In the woollen and cotton manufactures, the use of the fly shuttle is almost universal; but in the linen and silk it is still common to pass the shuttle through the warp by the weaver's hand. The boxes, drivers, spindles, and other apparatus used for throwing the

* So called from the weaver's depressing one end of the bore staff, in drawing off yarn from the warp beam.

fly shuttle, are unnecessary in working by the hand, and would, indeed, be encumbrances.

OPERATION OF WEAVING.

When a warp has been properly arranged in the loom, and all the machinery requisite for weaving it into cloth has been added, the business of the operative weaver depends more upon care and attention, than upon manual dexterity. *Silk* and *woollen* warps, which are animal substances, require little preparation after being put into the loom. In these it is only necessary for the weaver, occasionally, to clear his warp behind the rods, and to pick off, or pare away, any knots or lumps upon the yarn, which might present obstructions in passing through the headles or reed.

The clearing of the warp is generally done with a comb, which is drawn gently through it, the teeth being kept in an oblique direction, in order to avoid breaking the threads, when any obstruction presents itself.

For the operation of cleaning the warp, a pair of small shears is used. This operation is equally necessary in warps spun from the vegetable substances, *flax* and *cotton*.

But they require besides, a further preparation to fit them for the purpose of weaving: this is called

SIZING.

This operation is justly esteemed of the first importance in the art of weaving warps spun from flax or cotton, and even in fine woollen fabrics; for it is impossible to produce work of a good quality unless care be taken in sizing the warp.

The use of this process is to give to yarn sufficient strength or tenacity, to enable it to bear the operation of weaving. It also, by laying smoothly all the ends of the fibres which compose the raw material, from which the yarn is spun, tends both to diminish the friction during the process, and to render the fabric smooth and glossy. The substance in common use for sizing, is simply a mucilage of vegetable matter boiled in water. Wheat flour, and sometimes potatoes, are the substances commonly employed for cotton and linen. These answer sufficiently well, in giving to the yarn both the smoothness and tenacity required; but the great objection to them is, that they are too easily and rapidly affected by the operation of the atmosphere. When dressed yarn is allowed to stand exposed to the air for any considerable time, before being woven

into cloth, it always becomes hard, brittle, and apparently inflexible. It is then tedious and troublesome to weave, and the texture of the cloth is rough, wiry, and uneven. This effect is chiefly the case in dry weather, when the weavers of fine cloth find it indispensibly necessary to have their yarn wrought up as speedily as possible, after being dressed.

To counteract this inconvenience, herring, or beef brine, and other saline substances, which have a tendency to attract moisture, are sometimes mixed in small quantities with the sizing: but this has not proved completely successful, probably because the proportions have not been properly attended to, and because a superabundance of moisture is equally prejudicial with a deficiency. Indeed, the variation of the moisture in the air is so great and so frequent that it appears difficult, if not impossible, to fix any general, not to say universal rule, for the quantity to be mixed.

It will appear singular to weavers in this country, that in India, the process of weaving even their finest muslins, is conducted in the open air, and exposed to all the heat of the climate, which is intense.

We know well that by the common mode such would be impracticable with fine work in this country, even in an ordinary summer day. Weavers are obliged to work in damp shops, to prevent the size of the web from drying and hardening. It does not appear that this subject, which is of much importance, has, till lately, attracted the attention of scientific men: nor has it been treated in an accurate or philosophical manner. We have, very recently, been fortunate enough to procure some account of the substances which the Indian weavers employ for sizing their warps, and we gladly embrace this opportunity of making it publicly known, as we hope the information will prove an important benefit to the manufacturers of this country.

M. Dubue has lately read a memoir before the '*Academy of Sciences of Rouen*,' on the subject of '*Pastes, &c.*,' in which he shews, that the Indians use a very minute addition of *muriate of lime*,* to render them retentive, or absorbent of moisture. "Webs," says he, "sized with such paste as is generally used in this country, (France,) may be woven in the *upper* and *drier* chambers of a house, as well as in the lower and ill aired.

Muriate of lime may be obtained at a very trifling expense from those apothecaries, or others, who prepare water of ammonia.

* Monsieur Dubue should have likewise informed us where the Indians procured their *muriate of lime*.

The waste whitening steep of the bleacher is merely a solution of muriate of lime."

The Indians also, according to Forbes, use a kind of size which they make from a root called *kandri.*

In the sizing of woollen warps, glue is most commonly used. When the warp previously sized has been wrought up, as far as can be conveniently done, the weaver is obliged to suspend the operation of weaving, and to prepare a fresh quantity of warp. It is necessary to stop when the sized warp has approached within two or three inches of the back leaf of the headles, that room may be allowed to join the old sizing to the new. The first operation is to clear the warp with the comb, from the lease rod to the yarn beam, and the proof that this operation has been properly executed is, by bringing the rods, successively, from their working situation to the beam. When this has been done, the two rods nearest to the headles, are drawn out of the warp, and the lease rod only remains.

The next duty of the weaver is to examine the yarn about to be sized, and carefully to take away every knot, lump, or other obstruction, which might impede his progress, or injure the cloth. This being performed, he proceeds to apply the substance used for sizing, which should be rubbed on gently, but completely, into the whole warp, by means of two brushes, used in succession, one of which he holds in each hand. He then raises the lease rod on one edge to divide the warp, and sets the air in motion by means of a large *fan*, for the purpose of drying the warp which has been sized. It is proper in this stage of the operation, to draw one of the brushes *lightly* over the warp at intervals, in order to prevent any obstruction which might arise by the threads when agitated by the fan, cohering, or sticking to each other, whilst in a wet state. When the warp is sufficiently dried, a very small quantity of grease (tallow) is rubbed over it, with another brush kept for the purpose, the lease rod is again placed upon its flat side and cautiously shifted forward to the headles. The other rods are then put again into their respective sheds, and the process is finished.

WEAVING.

The operation of sizing the warp being over, the weaver again resumes that of forming the cloth. The operations required are only three; and these are very simple:

1st, *Opening* the *sheds* in the warp, alternately, by pressing down the treadles with his feet.

2d. Driving the shuttle through each shed when opened. This is performed by the right hand, when the fly shuttle is used, and by the right and left hand alternately, in the common hand loom.

3d. Pulling forward the lay to strike up the weft, and again pushing it back nearly to the headles. This is done by the left hand (as before stated,) with the fly, and by each hand successively in the old way. In describing operations so simple and uniform it is neither easy nor necessary, to go much into detail, and we wish above all to avoid repetition. It may be useful, however, in this place, to notice the mistakes into which inexperienced weavers are apt to fall, and the defects and inconveniencies which these occasion.

TREADING.

In the treading of a web most beginners are apt to apply the weight or force of the foot much too suddenly. The bad consequences attending this mistake are particularly felt in weaving fine or weak yarn. In weaving, as in every other branch of mechanics, the resistance, or reaction, is always nearly as great as the moving power or force which it is necessary to apply. From this it follows, that the body of the yarn must sustain a stress, nearly equal to the force with which the weaver's foot is applied to the treadle.

Besides this, every individual thread is subjected to all the friction occasioned by the headles and dents of the reed, between which the threads pass, and with which they are generally in contact in rising and sinking.

But the art of spinning has not been, as yet, and probably never can be, brought to such a degree of perfection, as to make every thread capable of bearing its proportion of the stress equally. It is alike confirmed both by mathematical demonstration, and by practical experience, that when any body is to be moved with increased velocity, it is necessary to exert greater power to move it; and as the resistance increases in proportion to the power, this sudden application of the pressure of the foot to the treadles, must cause a proportional increase of the stress upon the warp, and also of the friction.

Now as it is *almost* impossible to make every thread equally strong, and equally tight, those which are the weakest, or the tightest, must bear much more than their equal proportion of the stress. This causes them frequently to break, even with the greatest attention, and more time is lost in tying and replacing them, than would

have been sufficient for weaving a considerable length of cloth. But if the weaver, from inattention, should continue the operation, after one, or more threads are broken, the consequence would be still worse. When a thread has been broken it no longer retains its parallel situation to the rest, but crossing over, or between those nearest to it, either breaks them also, or interrupts the passage of the shuttle; frequently it does both. The same reasons will sufficiently prove the error of another opinion, too common among conceited or ignorant weavers, especially the younger part of them. This is, that a greater quantity of cloth will be produced, in proportion as every motion is performed with increased rapidity. It is unquestionably true, that time will be lost by conducting the operations too slowly: but it is equally certain, that there is a rate of velocity, beyond which it is improper to accelerate the motions of a loom. What the precise rate of this velocity in hand loom weaving should be, has not, as we believe, been correctly ascertained. Indeed, it must vary considerably, according to the breadth of the web, the skill of the workman, the nature of the fabric, and the strength of the materials.

Instead, therefore, of giving precise rules of motion, we shall here insert a few calculations of the quantities of work which may be produced by uniform and incessant motion, at rates usually reckoned slow.

In a 4-4 cotton shawl, let the warp be 1000, and the weft 1200, it will follow, that the shuttle must be driven 2400 times across the web to produce one square yard of cloth. Now, if this is done 60 times per minute, the whole will be completed in 40 minutes, supposing no time to be lost. But as this is *scarcely* possible, allow *one fifth* of the time to be occupied in tying threads, changing quills, and other necessary operations, and still the yard of cloth will be completed in 50 minutes.

Again, in a 1200 6-4 web, (*even wefted*,) let the time of weaving a yard *in length*, be computed at the rate of 40 picks per minute; this, with the former allowance of one fifth part of the time for stopping, will be done in *one hour and* 15 *minutes.* Yet every *experienced* weaver will be satisfied that looms, regularly and constantly kept going at the above rates, will produce more cloth than is usually effected, even by the most rapid motions.

No allowance is made here for the time employed in sizing, because this is supposed to be the same whether the weaving is performed quickly or slowly.

These illustrations, which are confirmed by the practical obser-

vation of every experienced weaver, will be sufficient for the present. The subject will be more fully discussed, when we come to investigate the methods of weaving *by power*.

We shall then treat of sizing whole webs by the aid of machinery, and of the best rates of speed adapted for weaving the various kinds of goods to which power can be applied.

CROSSING THE SHUTTLE.

This, like the former motion, should be performed with a regular and uniform velocity.

In every kind of weaving, and especially in thin wiry fabrics, much of the beauty of the cloth depends upon the weft being well stretched. But if the motion of the shuttle be too rapid, it is apt to recoil, and thus to slacken the thread. It has also a greater tendency either to break the weft altogether, or to unwind it from the quill in *doubles*, which, if not picked out, destroy the regularity of the fabric. The weft of muslins and thin cotton goods, is generally woven into the cloth in a wet state.

This tends to lay the ends of the fibres of the cotton smooth and parallel, and its effect is similar to that of sizing the warp.

The person who winds the weft upon the quill or bobbin must be very careful that it be well built, so as to unwind freely.

The best shape for those used in the fly shuttle, is that of a *cone*,* and the thread should traverse freely, in the form of a spiral or screw, during the operation of winding.

The same wheel used for winding the warp upon bobbins, is also fit for winding the weft. It only requires a spindle of a little different shape. The wheel is so constructed, that the spindles may be easily shifted, to adapt it for either purpose.

STRIKING UP THE WEFT.

That the cloth may be uniform in thickness it is necessary, that the lay should be brought forward with the same force every time. In the common operation of weaving, this regularity must be acquired by practice.

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* Messrs. Farquhar and Gunn of Glasgow, Scotland, make the best fly-shuttle bobbin winding machines in Europe, and particularly for power looms, where striped or checked goods are woven. These machines contain from 12 to 100 bobbins each, which they build in the form of a cone. We would advise manufacturers of such goods to procure sample machines from these gentlemen.

It is, however, of consequence to the weaver, to mount his loom in such a manner, that the range of his lay may be in proportion to the thickness of his cloth. As the lay swings backward and forward, upon centres placed above, its motion is similar to that of a pendulum; and the greater the arc or range through which it passes, the greater will be its effect in pressing up the weft. For this reason, in weaving coarse and heavy goods, the headles should be hung at a greater distance from the point where the weft is struck up, than would be proper in light work. The point, or rather line, where the last thread has been struck up, is called by weavers the *fell*.

The pivots upon which the lay vibrates ought, in general, to be exactly at equal distances from a line drawn perpendicular to the fell, and one drawn perpendicular to the headles, and between these two lines. But as the fell is constantly varying in its situation, (in hand loom weaving) during the operation, it will be proper to take the medium. This is the place where the fell will be when a *bore* (one pull of the warp) is half wrought up.

From this the following conclusion may also be drawn:

The *bores* ought always to be *short* in weaving light goods; for, the less the extremes vary from the medium, the more regular will be the arc, or swing of the lay.

The result of what has been stated above is, that in each of the three operations of weaving, the motions should be constant and uniform, and, that they should follow each other in regular succession. But some observations will be necessary to adapt these to different species of cloth.

The beauty or excellence of some cloths consists in the closeness of their texture, that of others in the openness and regularity of the intervals between the threads. When the latter of these is required, the weaver must vary his process from that which would be proper in the former.

The extreme tightness of the weft is a principal excellence in open goods, and is, to a certain degree, necessary in the others; but by no means to the same extent; two alterations are, therefore, necessary in the formation of such fabrics. The first is in the mounting of the loom, the second, in the operation.

By referring to Fig. 7 it will appear, that the threads of the warp pass from the yarn beam to the cloth roller upon a level, or horizontal straight line, consequently, the half of the warp which rises and the half which sinks, will deviate equally from a straight line, and be equally stretched. When this is the case the threads of

warp which pass through the same interval in the reed, will appear close together in the cloth with a vacancy between them, and those next to them; which vacancy is caused by the intervention of the dents in the reed. But if the yarn beam is raised considerably above the level of the headles, the warp when at rest, will no longer be in a straight line; and when the shed is opened, that half of the warp which descends, will be drawn considerably tighter than the half which rises. Thus each half will be slackened alternately, and the consequence of this is, *that the warp spreads in the cloth, and the intervals caused by the dent of the reed are no longer discernable.*

The former of these ways of placing the loom is practised in thin work, the latter in thick.

When the weft has been thrown across the warp, *if the fabric is thin, the lay is brought up rather before the shed is closed,* in order that the weft may be struck up as tight or as stretched as possible; but in weaving thick goods, *the shed is closed before the stroke of the lay is given.*

In consequence of this, the threads of the warp, to a certain degree, slacken the weft, and give a close appearance to the cloth.

In weaving thick cotton goods, the weft is inserted in a wet state, when the fabric is wanted to appear very close.

It may now be proper to notice the defects which most commonly occur in the weaving of cloth, and to explain the causes from which they arise.

When from any cause, the weft is not regularly interwoven with the warp, a deficiency must happen in the cloth, which is called by weavers a *scobb* or *blotch.*

This may proceed from several causes, the most frequent is some obstruction in the warp, which prevents any portion of it from rising or sinking regularly when the shed is formed; of course, the shuttle, instead of passing fairly between the threads of the warp, passes either over or under the portion which is obstructed, and the weft at that place is not at all interwoven with the warp.

A knot or lump upon the warp, if not picked off, will often obstruct two or three threads, and form a small scobb. When the weaver, from inattention, continues to weave after a thread of warp has been broken, it very frequently crosses between a number of others nearest to it, and by obstructing the shed in that place, will cause a large scobb. Scobbs are also sometimes produced by the lay being too low or too high, but this is more frequent in weaving

with the hand shuttle than with the fly. In this case the scobbs are always near the *list or selvage* of the cloth.

A second fault in cloth is known among weavers by the name of a *jisp or shire.* This is most frequent in light fabrics, and is occasioned by any particular thread of weft not being struck up so close as the rest. Jisps are very frequently occasioned by defects either in the construction or mounting of the loom. If either the yarn beam or cloth beam be not turned very true, jisping will be unavoidable, or if either the headles or the lay be not hung parallel to the beams, the same defect will ensue. *If the loom is correctly made and mounted, the fault must be with the weaver,* and this is only to be surmounted by attention and practice.

The other faults in cloth generally proceed from inattention in the management of the warp or weft. If threads are inaccurately drawn through either the headles or the reed, the defect will be apparent in the cloth.

There is nothing that adds more to the beauty of cloth of every description, and about which good weavers are more solicitous, than a *tight uniform selvage.* In order to produce this, the warp must be sized even with greater care than what is necessary in the middle of the web. The tightness of the weft, also, contributes materially to the beauty of the selvage. It is sometimes customary to warp a few dentfuls at each selvage with coarser yarn than the body of the web. In many kinds of cloth, however, the common practice is to draw the threads which form the selvage double. That is, to draw two threads through each headle.

The threads which form the warp of the selvage being coarser than the rest, and also being drawn more towards the middle of the web by the weft, the intervals of the reed through which they pass, are apt to be worn much sooner than the others. A weaver should carefully attend to this, for if the reed is injured, the work cannot be good. When cane reeds are used, and when the webs wrought in them are of one breadth, it is very common to make those dents between which the warp of the selvages passes, of brass or steel.

It is unnecessary to enumerate further, the defects which may occur in the weaving of cloth, *for no instruction can altogether supply the want of skill, which is only to be obtained by practical experience.*

Having finished the foregoing general account of the nature and process of weaving, it now becomes necessary to pay some attention to the fancy and ornamental department of the business. Of fancy goods, many descriptions are woven in the common loom,

without any additional apparatus, and with little, if any, variation from the process of weaving plain cloths. The extent to which this species of manufacture is carried, renders it an object of very great importance, and the variation in the operative part of the process is so small, that it may be introduced under the description of plain weaving, with little violation of arrangement.

As the thickness of the texture of plain cloth depends upon the proportion which the fineness of the yarn bears to the measure or *set* of the reed, it follows, that if yarns of different degrees of fineness are introduced at regular intervals into the same web, two distinct textures, or qualities of cloth, will be produced, and that the appearance of these will be different when the web is finished. Yarns of different colours may also be introduced, and when either of these is practised the goods are called.

STRIPES.

Stripes are formed upon cloth either by the warp, or by the weft. When the former of these ways is practised, the variation of process is chiefly the business of the warper, in the latter case it is that of the weaver. In extensive manufactories, where large quantities of striped goods of the same description are to be made, it is common to form the stripes in the warping, because in this case, the stripes and their distances from each other will be uniform, which cannot be always relied upon where the stripes are formed by the weft.

In warp stripes, where the colour is the same, and the difference is in the fabric, the effect may be produced either by using yarns of different fineness, or by drawing a greater quantity of warp through a given number of headles or intervals of the reed, where the stripes are to be formed. For example, two, or more threads, may be drawn through the same headle eye, or three, or more *headlefuls* may be drawn through the same interval of the reed, or thirdly, if the stripe is to be very thick, both these ways may be adopted.

CHECKS.

The patterns of checks may be either similar, or dissimilar in the warp and weft. The former is the most prevalent. Checks, being merely combinations of the two methods of striping, require no further description; and as they contain, most frequently, a mixture of colours, their beauty depends more upon the taste and fancy of the manufacturer and the skill of the dyer, than upon that of the

weaver, *whose business is merely to make the cloth of a good quality*, and insert his weft according to the pattern.

Stripes and checks are manufactured in great quantities from all the different materials, especially from woollen, silk, or cotton. When the patterns of checks differ at the borders from the middle or bosom of the web, they are called shawls or handkerchiefs. It is very common to weave these with borders only, the bosoms being left plain; in this case the check work is only at the corners, the rest of the four borders appearing as stripes, two by the warp, and two by the weft.

WARPING OF STRIPED WEBS, &c.

To compose a pattern for a striped web, you must begin by counting the number of threads in one stripe, then take half that number, if it is two threads per dent, if four, take the fourth of it; if 8 threads, $\frac{1}{8}$, &c., which will give the number of dents in a stripe. Measure the width of the stripe, so as to ascertain how many times it is to be repeated in the breadth of the web. Multiply the number of times by the dents in the stripe, and you will have the entire quantity of dents in the web. Divide the number of threads in the web by 80, and as 80 threads is a *porter*, you will thus find the number of porters. The following example will explain this:

Suppose that one stripe contains 100 dents with three threads in each, and that there are 10 stripes in the whole breadth of the web, we may find the number of patterns or repeats thus:

```
    100  dents in the stripe
     10  repeats or stripes
   ----
   1000  dents in the web
      3  threads per dent
   ----
80)3000(37 (Porters)   Threads in the web
   240
   ---
    600
    560
    ---
     40  threads over
```

By this we see that 3000 threads give 37½ porters, 40 threads being half a porter.

SECTION SECOND.

TWEELING.

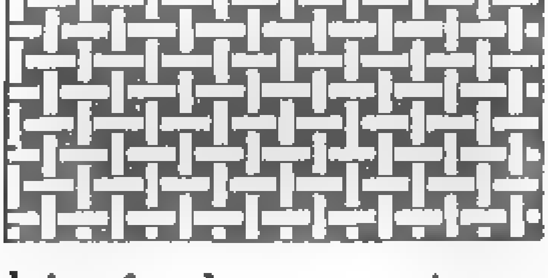
TWEELED CLOTH.

This species of weaving derives its name from the French word *touaille*, and is generally confined to thick fabrics.

In analyzing the texture of plain cloth, it has been shown, that every thread of the warp and of the weft cross each other at right angles, and are tacked together alternately. This is not the case in tweeling, for in this branch of weaving only the third, fourth, fifth, sixth, &c. threads cross each other. Tweeled cloths are produced of many different kinds. In the coarsest species every third thread is crossed, and this is commonly called the *blanket tweel*, in finer fabrics they intersect each other at intervals of 4, 5, 6, 7, or 8 threads, and in some silk stuffs the crossing does not take place until the 16th interval, which is denominated the *full satin tweel*.

Before proceeding further it may be proper to explain what is known among weavers by the appellation of *flushing*. When any thread or portion, whether of warp or weft, *is not regularly interwoven in the cloth, as in plain weaving, that thread or portion of threads is said to be flushed.* By referring to the following Figs. this will be more clearly illustrated.

Fig. 13.



In Fig. 13, which is referred to as a specimen of plain cloth, as it would appear *when viewed through a microscope*, the intersections of the threads are evidently alternate.

Fig. 14.

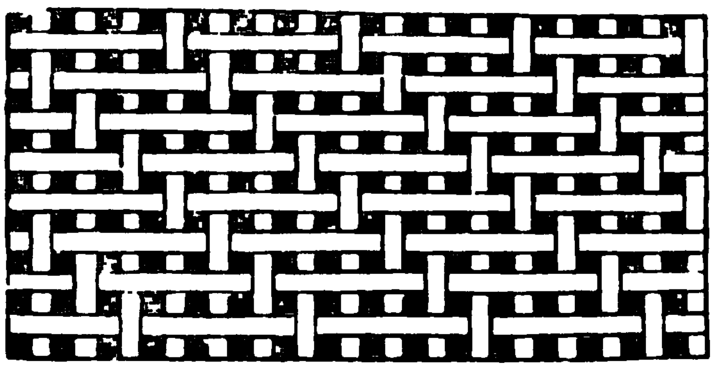


Fig. 14 may be considered as a representation of tweeled cloth, upon the same principle that Fig. 13 represents plain. This fig. will show that the same thread of weft remains flushed or disengaged from the warp while passing *over* three threads, and is tacked down by passing *under* the fourth. Now, were this cloth turned upside down, the same appearance would take place in the warp. That is to say, every fourth thread of the warp would be interwoven with the weft and the remaining three threads would be flushed. An inspection of the Fig. will also convince the reader, that the threads, both of the warp and weft, are interwoven at regular intervals.

To produce these effects a number of leaves of headles are required, equal to the number of threads contained in the interval between each intersection, *inclusive*. Thus, when every third thread is to be interwoven, three leaves are required; if every sixth thread, six leaves will be necessary; and so of all the others. For this reason, the different species of tweels are distinguished by the number of leaves which are requisite in weaving them, as a four, five, or six *leaf* tweel, &c. The specimen in Fig. 14 is a four leaf tweel.

Tweeling is, in many instances, applied to the weaving of cloths which require a great portion of strength, thickness, and durability.

In the silk manufacture tweeling is very common. Sometimes it is employed for the sake of strength, but more frequently for the display of colour. In the woollen, strength is the general object, and in the cotton it is most commonly the same.

It may be necessary in this place to enquire into the causes which render tweeled cloths stronger than plain, and to ascertain the difference.

In so far as the strength of tweeled cloths depends solely on the mode of weaving, that strength will be rather diminished than increased, when compared with plain cloth, containing an equal quantity of similar materials. For in the texture of plain cloth every thread is alternately interwoven, while in that of tweels they

are only interwoven at intervals. Now, in the latter case, the threads can derive no mutual support from each other, except at the intervals where they are interwoven, and that part of them which is flushed must depend entirely on the strength of the individual threads, those of the warp being flushed upon one side, and those of the weft upon the other.

The following inference will naturally arise from this: let two webs of equal length, breadth, quantity, and fineness of yarn, be woven; let the first be plain and the second tweeled, and their strength ought to be the same. But if by *strength*, we understand that property which opposes the most effectual and most continued resistance to the decay of cloth, from common wearing, the tweeled web (if equally used) would be in tatters long before the plain one would be materially injured. This is the idea commonly, although inaccurately, attached to the word strength when applied to the texture of cloth; and, indeed, the above remark will not be found universally true, for the durability of cloth exposed only to common wearing, depends partly upon its strength, and partly upon its flexibility.

It is not, therefore, in the effect of the mechanical operation, but in the facility of combining a greater quantity of materials in the same space, which this mode of weaving affords, that we are to look for superior strength or durability. This may be easily illustrated: when the shed of any web is opened, every thread of warp, either above or below the thread of weft, will oppose a certain resistance to the operation of the reed in driving the weft thread home, and the sum of all these will be the total amount of resistance. Now, in plain weaving, as before stated, every thread is alternately interwoven, and therefore, opposes its portion of resistance; whereas, in a *four leaf tweel* every fourth thread only is intersected, and of course, less resistance is given. The ratio of resistance, therefore, will be *inversely*, in proportion to the number of leaves of headles in the tweel.

In the warp the friction on the reed will be diminished, in the same proportion; for each warp thread, instead of changing its place every time the weft thread crosses, changes only once every four times; consequently, much more warp may be crowded into the same space than could be done in plain weaving.

From the above we may safely deduce, that the strength or durability of a tweeled web, will be somewhat less than the proportion of materials it contains will be to that of a plain web, supposing each to be of equal strength and quality.

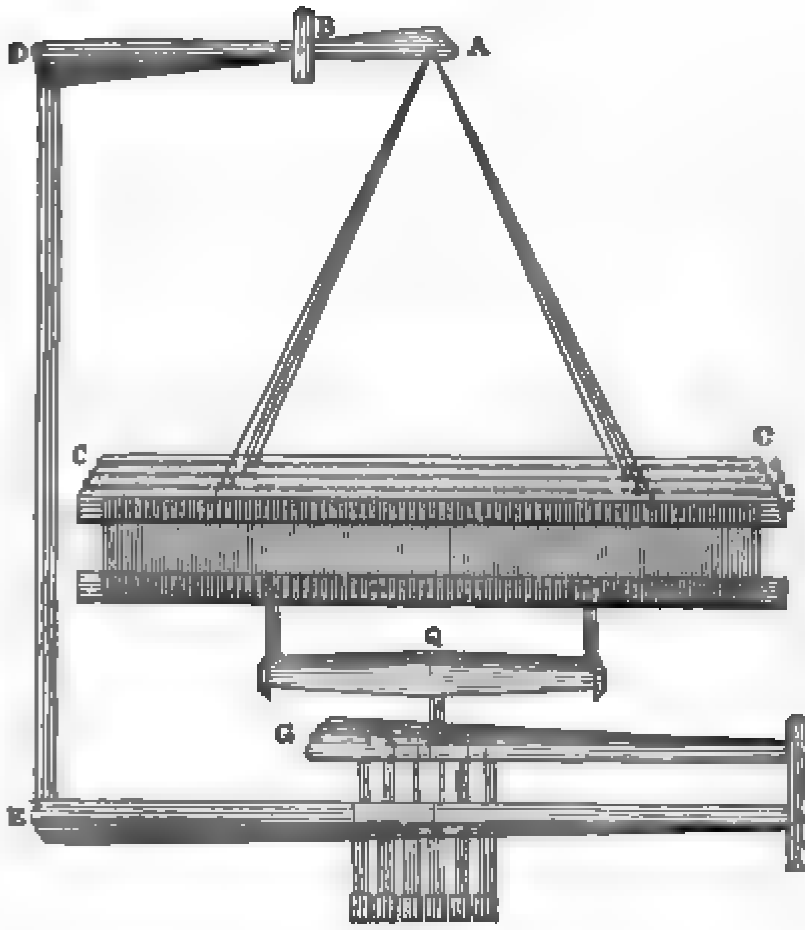
But when the fabric is very close, tweeled cloth possesses another advantage over plain in point of durability. When the warp of plain cloth is very much crowded in the reed, and the weft driven very closely up, the threads, in order to cross each other alternately, must deviate very considerably from a straight line, whereas, when woven they become serpentine. This renders the cloth very liable to be easily cut or chafed, especially when composed of hard and comparatively inflexible materials, such as flax ; and the defect is chiefly observable in stout linens. But in tweeled cloth, as the threads only cross at intervals, the deviation from the straight line is much less, and the flexibility of the cloth, of course, much greater.

The same general remarks which have been given in the first section, apply almost equally well to the operations of the weaver in all descriptions of work. The varieties consist, chiefly, in the modes of arranging the loom, so as to enable the weaver to produce the desired effect.

MOUNTING OF LOOMS FOR TWEELING.

As almost every variety of fancy weaving is produced by the order and succession in which the weft is interwoven with the warp, the principal difference in *mounting* the looms is in the number and arrangement of the leaves of the headles, and the apparatus for moving them. In weaving plain cloth, the jacks represented in Fig. 8, at FF, answer the purpose sufficiently well, because the raising and sinking of every thread is alternate. But, in the weaving of tweels and many other kinds of ornamental and fancy cloth, the number of leaves is generally greater, and these are to be raised and sunk successively, or not, as the nature of the case may require. It is therefore necessary, that the mounting of the loom should be adapted to the purpose for which it is intended, and as the succession of working the headles by means of the treadles may frequently vary, the mounting which connects every leaf with the treadle, and from which its motion is derived, must be such that the leaf may be raised or sunk independent of all the others. A representation of the mechanism used for this purpose, by many skilful weavers, will be found in Fig. 15.

Fig. 15.



In this figure *four* leaves of the headles are represente
perpendicularly above which are *four* levers, moving upon
at B. From one end of each of these levers at A, a leaf
headles is suspended by the two *oblique placed* cords: the
meeting below the lever, continue as a single cord to pass t
a groove in its end, and are then made fast to it. Below the
are two sets of *marches* or levers, consisting of four each
are moveable at the centres F and I. The long marches
tinguished by the letter E, the short by G. Each of the fo
marches is connected with the end of the corresponding to
at D, each short march is connected with the lower shaft
leaf of the headles to which it is to give motion.

Now, as each of these marches is connected with one leaf
headles, it follows, that if a *long* march is pulled down, the l
rise; if a short is pulled down, the leaf will sink.

This will be apparent, when it is considered that the cord
form a direct connexion between the *lower* headle shafts a
short marches. Of course, when one of the latter is pulled
those of the former, with which it is connected, must sin
But the motion communicated from the *long* marches to th
shafts is reversed at the centre of the top levers; for when

D is pulled down, the end A will rise, and the corresponding headle leaf will be pulled up. These top levers are known among weavers by the name of *coupers.*

The arrangement of this apparatus, although very simple, ought to be carefully studied by those who are not conversant with the practice of weaving, for it is very generally used, in almost every species of ornamental work. The ends of the top levers or coupers at A, which contain the grooves for the suspending cords, ought to be segments of a circle, the radius of which is equal to the distance of the groove from the centre of motion at B, in order that the pull may be uniformly perpendicular. The distance of the centre B from the end D is, generally, made twice as great as that from A to B, for otherwise the long marches would communicate too great a range of motion to the rising headles. If greater accuracy is wanted, the ranges of the different levers, and the ratio which they bear to each other, may be calculated by the same rules which apply to all other motions communicated by means of levers, and these are explained in almost every elementary treatise upon mechanics.

When the connections between the headles and marches have been formed, agreeably to the above description, it is only necessary to arrange the treadles, and to connect each with the marches which it is intended to move.

It is a common rule in fancy weaving, that every individual treadle should be connected with all the leaves of the headles, for the purpose of raising some and sinking the rest. Some exceptions to this rule however, occur; but these are few, and will be particularly noticed, when the cases to which they relate are being investigated.

The connecting cords between the marches and treadles are applied in the manner proper for weaving a web which may be tweeled or plain. This kind of mounting is often used for cloths *in which the ground is woven plain, and stripes tweeled by the weft, occasionally introduced.* If the figure is carefully examined, the connection of each treadle with the marches may be easily distinguished by comparing the lines which represent the cords, with the description which will be afterwards given.

But previous to this, it may be useful to explain the mode of drawing plans upon paper to direct the weaver in drawing his warp through the headles, and of applying the cords by which these headles are to be worked ; these plans are generally called the

DRAUGHT AND CORDING.

Plans of this description may be considered as horizontal sections of a loom, for the purpose of showing the headles and treadles. Although the treadles of a loom are placed directly under the headles, it is usual to represent them at one side, upon the paper, or draught, for the sake of easier reference from the one to the other.

Fig. 16.

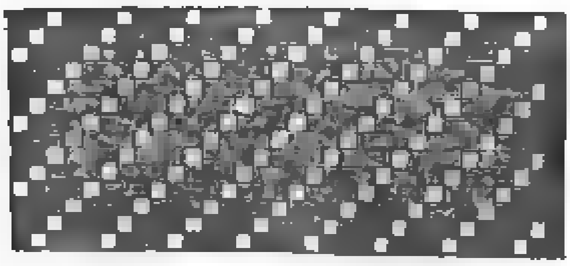
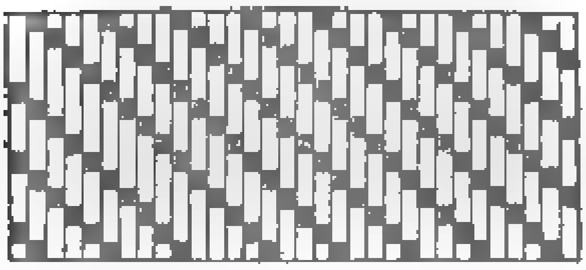


Fig. 17.



Figs. 16 and 17, are representations of tweels of four leaves, and as the fabric of tweeled cloth is generally thick and close, they, being on a large scale, will convey a clear idea of its appearance, as they are designed to give an accurate representation of the intersections of the threads. If we suppose that the warp of a tweeled web is of white yarn, and that the weft is black, Fig. 16 will convey a correct idea of the appearance of the upper side of a web when woven in a loom mounted with four leaves of headles, every fourth leaf being raised and three sunk; and Fig. 17 will represent the appearance of the under side of the same web; for in Fig. 17 the white warp appears flushed, and in Fig. 16 the black weft is flushed. Now, were the cording reversed, that is to say, were three leaves to rise and one to sink when each treadle is pressed down, the effect would be quite the same, excepting that the upper side would then be flushed by the weft, as in Fig. 16 and the under by the warp, as in Fig. 17. This reversing of the flushing, which may be effected by additional mounting, is the principle upon which the ornamental figures upon many kinds of tweeled cloth depends.

We shall have occasion to treat of this hereafter.

ARRANGEMENT OF TREADLES.

When a great number of treadles are necessary to produce any effect, it will be obviously the best way to arrange them in the succession in which they are to be pressed down by the weaver's foot, or feet, when this is practicable. For if some regular order be not adopted, the weaver will frequently be apt to mistake the treadle and press down a wrong one. In heavy fabrics, where great power must be applied, the weaver is generally obliged to use both his feet on the same treadle, as well as the whole weight of his body. In this case it is common to place the treadles in regular succession from right to left, as—

6—5—4—3—2—1.

But when the fabric is lighter, and when the pressure of one foot is sufficient, it will be more convenient to arrange the treadles so that the right and left foot may be applied alternately, without crossing each other. When this is the case, the weaver, while treading with one foot, has sufficient time to shift the other to the next treadle, without impeding the operation. This naturally leads us to commence our succession at the centre, and to place the succeeding treadles alternately upon each side, as—

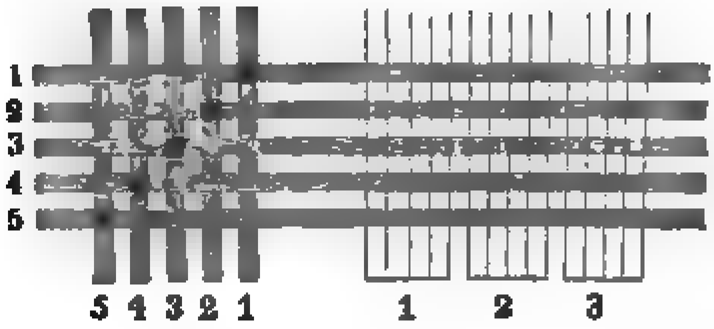
5—3—1—2—4—6.

In this case the treadles 1, 3, and 5 will be wrought by the left foot, and the treadles 2, 4, and 6 by the right; and by applying the feet alternately, the treadles from 1 to 6 will be wrought in the regular order adopted in the elevation Fig. 15.

In Fig. 15, four treadles are required for the tweel and two for working the web plain. The former are distinguished by numbers, the latter by the letters AB.

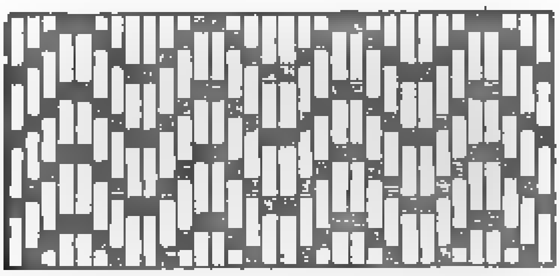
In all the plans given it is to be understood that when two treadles are applied for the purpose of working the web plain, these treadles are always distinguished by the letters AB. All treadles for the fancy part are distinguished by numbers, and the placing of these numbers gives the order in which the treadles ought to be wrought. Fig. 18

Fig. 18.



shows the draught and cording of a loom, mounted for working a tweel consisting of five leaves of headles. The only difference between this and the four leaf tweel is in the number of the leaves and treadles. The drawing of the warp through the headles proceeds in the same regular succession from right to left, and the treadles are arranged in the same order. In Fig. 18, five of the lines which represent the threads of the warp are connected by each cross line, five threads therefore are to be drawn through each interval of the reed. Fig. 19

Fig. 19.



represents a kind of ornamental tweel, produced, merely, by reversing the order in which the warp is drawn through the headles. The plan for drawing and cording a web of this description will be found by referring to Fig. 20.

Fig. 20.

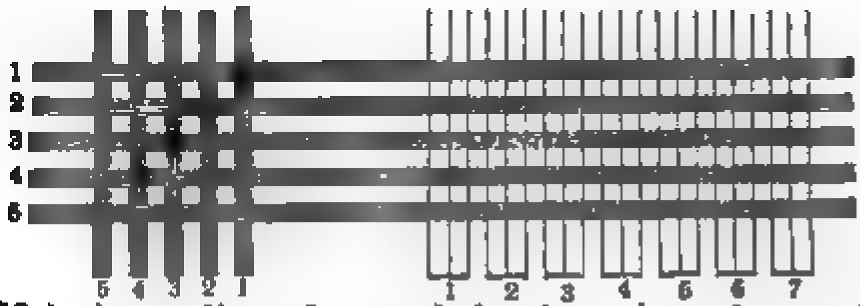


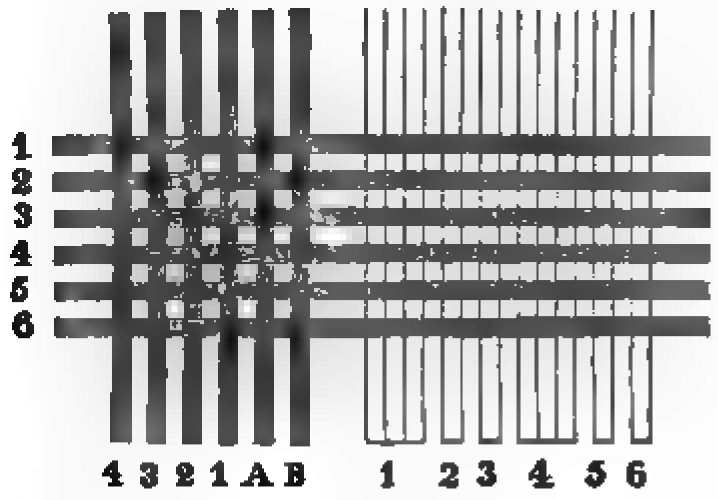
Fig. 20 is the cording of a tweeled stripe, where the tweeling is reversed in the draught, in a way similar to that shown in Fig. 19. Stripes of this kind are called by weavers *herring bones*, from their resemblance to the back bone of that *native* of the deep. The draught and cording will appear by inspection, if the explanations already given are fully understood.

We have hitherto considered all the threads of warp in tweeled cloth, as interwoven in progressive succession, for the sake of rendering the general principle of tweeling more obvious to those *previously unacquainted* with this branch of weaving. When tweels do not exceed four leaves, this arrangement is always adopted, but when a greater number of leaves is used, a kind of alternate succession is esteemed preferable : this is called by weavers

BREAKING THE TWEEL.

When a tweel consists of many leaves, the *flushing of both warp and weft* would be so great, that the intervals between the points at which they are interwoven would necessarily be very flimsy, (as in many kinds of French fancy vestings) and the fabric very unequal. To obviate this inconvenience, the broken tweel is used. The same mounting by which a regular tweel is wrought, will also work a broken tweel by treading in different succession. But this would derange the order of the treadles, and, as mentioned before, might be productive of many mistakes. Weavers therefore prefer placing the cording so that the regular succession of the treadles may be preserved, while the effect of the broken tweel is at the same time produced. An example of each of these follows: The first, Fig. 21,

Fig. 21.



is a plan for mounting a loom, so as to produce both plain and tweeled cloth at the same time. Such plans are generally adopted, when it is requisite to weave webs, the grounds of which are to be plain, and the stripes tweeled by the warp. Two treadles are added, to enable the weaver to work the whole fabric plain, if necessary. If not required, the two plain treadles A B may be omitted. In this plan, the leaves 1, 2, 3 and 4 contain that portion of the warp which is to form the tweeling or stripes, the leaves A B, that portion which is to form the ground or intervals. An examination of the mode of applying the cording will evince that when the treadles 1, 2, 3 and 4 are pressed down in the order of the numbers, the tweeling leaves 1, 2, 3 and 4 will rise successively, and the plain leaves A B alternately. The draught of the warp through the reed, as denoted by the cross lines, is here adapted to the purpose of rendering the tweeled stripes more close and compact than the plain ground; for of the former four threads pass through each interval,

and of the latter only two. But if the whole is to be wrought plain, occasionally, the entire warp should be equally drawn through both the headles and reed. This case very rarely occurs. Fig. 22 is a plan of a plain and tweeled stripe, and Fig. 23 is its draught and cording.

Fig. 22.

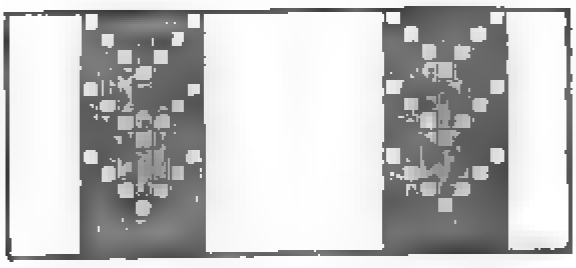


Fig. 23.

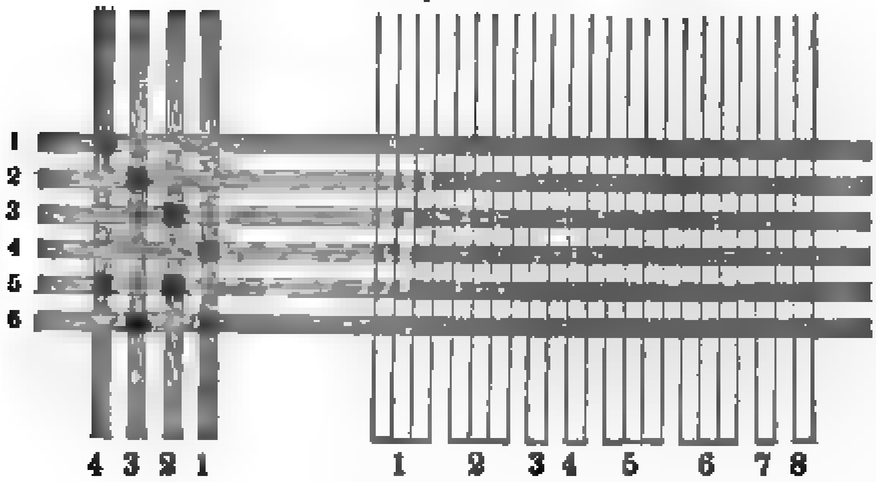
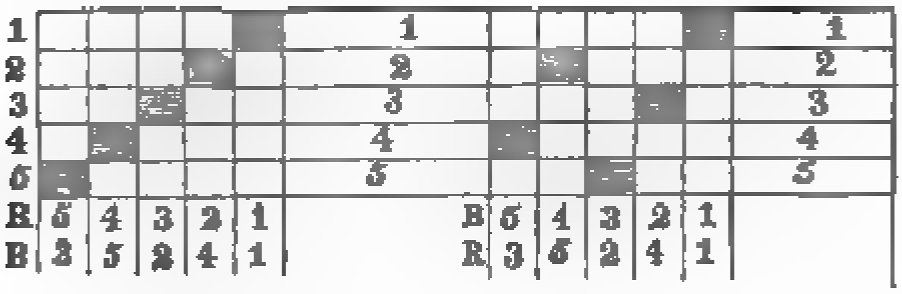


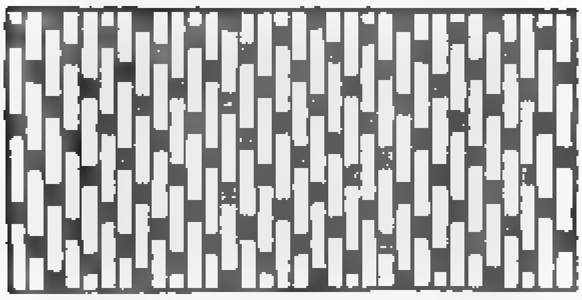
Fig. 24 is a regular five leaf tweel, the same as Fig. 18. Fig. 25 is the same tweel broken; and the succession of the treading, to produce either the regular, or broken tweel, is expressed by the numbers annexed to each.

Fig. 24. Fig. 25.



The above example will sufficiently show the two ways of tweeling: and also that the whole difference in the cording is solely to preserve a regular order in the treadles. The same succession of treading which breaks the tweel in Fig. 25, restores its regularity in Fig. 24. In these, and the following examples, each interval between the lines denotes a leaf of the headles. Numbers are used to show the order and succession in which the threads are drawn, and the dark squares denote the raising cords; which squares we prefer to use instead of cyphers, as they are more like design paper.

Fig. 26.



is a specimen of the effect and appearance of a five leaf tweel, broken in this way, as viewed on the side where the warp is flushed. In the same way, tweels of six, and seven leaves are drawn and mounted. The following are examples of each :

SIX LEAF TWEELS.

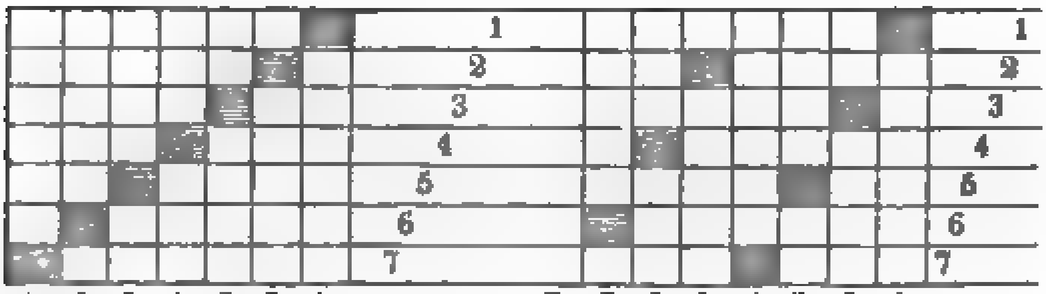
Fig. 27. Regular. Fig. 28. Broken.

R. 6 5 4 3 2 1
B. 6 4 2 5 3 1

B. 6 5 4 3 2 1
R. 6 4 2 5 3 1

SEVEN LEAF TWEELS.

Fig. 29. Regular. Fig. 30. Broken.



R. 7 6 5 4 3 2 1
B. 6 4 2 7 5 3 1

B. 7 6 5 4 3 2 1
R. 6 4 2 7 5 3 1

These examples will show the manner of forming the alternate or broken tweel. It is to be observed that the cording may be adapted in various ways, and the tweel broken in several places, according to the discretion of the weaver. When the number of leaves will admit of it, the succession should be made, as nearly as possible, at equal intervals. For example, in the broken tweel of six leaves, (shown in Fig. 28,) all the leaves ought to follow each other in succession, passing one leaf between each until you come to the sixth treadle, but as the first treadle immediately follows the

sixth in repeating the operation, there will be no interval there; and the effect of these two leaves will be that of a regular tweel, while all the rest give that of a broken tweel. There is also an interval of two leaves between the intersection produced by the third and fourth treadles.

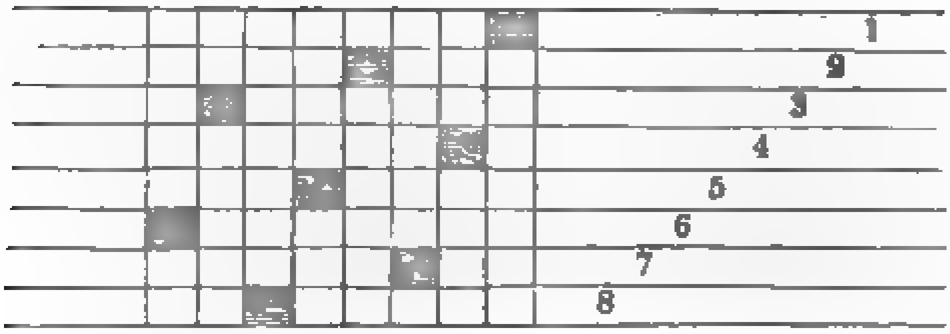
This, however, cannot be avoided in working with six leaves; this number, therefore, although given as an illustration, ought to be avoided in practice. The five leaf tweel also, though much used, has an interval of two leaves between the third and fourth treadle.

When eight leaves are employed, the succession in breaking the tweel is different, and disposes the warp at intervals more perfectly than any tweel that can be formed by a smaller number of leaves.

In all the former, the interval is formed by passing one leaf between every two until the whole are corded, but in the eight leaf tweel two leaves are omitted, and the third has the raising cord applied, as will be seen by the following example, Fig. 31.

EIGHT LEAF DAMASK TWEEL, OR HALF SATIN.

Fig. 31.



Broken.	8	7	6	5	4	3	2	1
Regular.	6	3	8	5	2	7	4	1

It is unnecessary to give further explanation of the eight leaf tweel, because it proceeds exactly like those already given; besides, with so many leaves, regular tweeling is seldom used. By examining this cording it will appear, that the intervals by which the tweel is broken are perfectly regular, for the first treadle succeeds the eighth at the same interval as all the others.

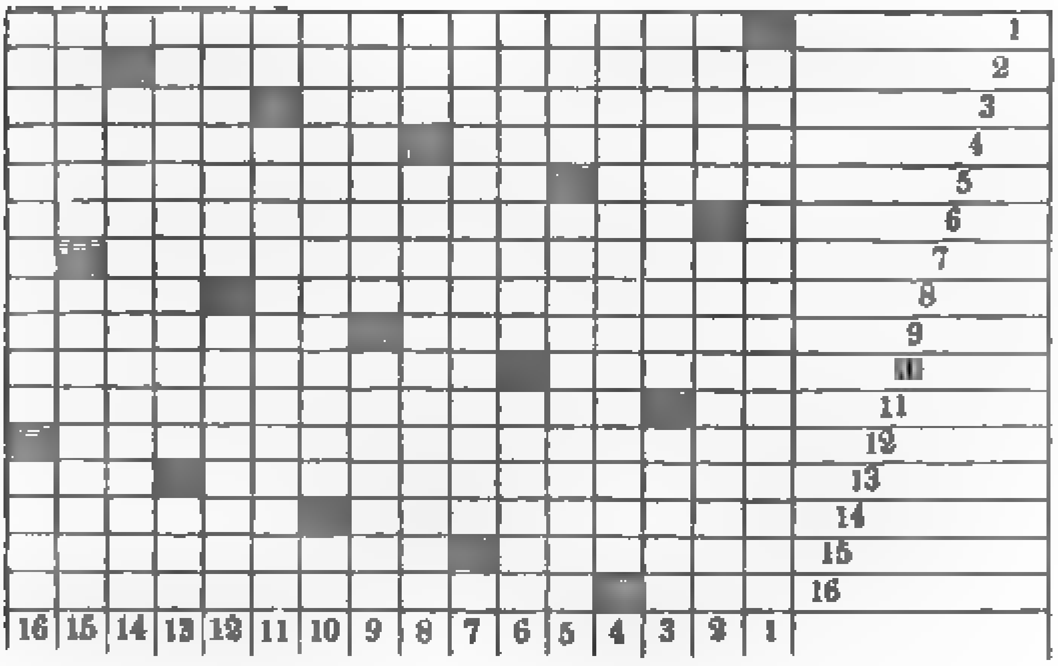
It is to be observed of satin tweels, that some are perfect in respect to the intervals at which the leaves can be raised, and others are imperfect. When the leaves can be raised regularly at intervals of one, two or more from each other, the tweel is said to be perfect; but imperfect when the number of leaves does not admit of this arrangement. The lowest tweel that can be broken is that of four leaves, which is usually called the *satinett* tweel.

The last specimen of common tweels which we shall give, is that

of sixteen leaves, and is only to be found in some of the very fine Chinese, Italian, French and English silk fabrics. Here the tweel is broken by omitting four leaves and cording the fifth.

SIXTEEN LEAF, OR FULL SATIN TWEEL.

Fig. 32.



Having finished our observations, for the present, on this part of our subject, and given such examples as appear necessary to convey a sufficient knowledge of the principles of common tweeling, of the varieties of which it is susceptible, and of the machinery requisite for weaving the various kinds, our next object is to investigate the means by which looms are adapted to the weaving of

TWEELED STRIPES.

In the references to Figs. 16 and 17, the flushing upon tweeled cloth has been explained. *On one side the warp is flushed, on the other the weft.* Most kinds of fancy tweeled stripes are produced by the application of this principle.

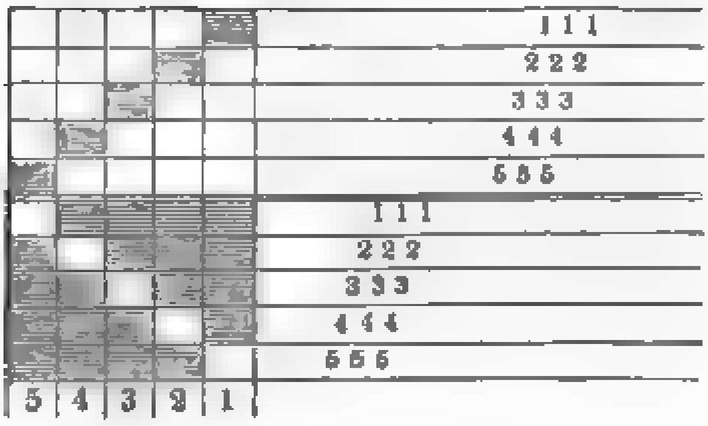
Stripes upon tweeled cloth differ from those upon plain in the following respects: tweeled stripes may be formed without any distinction in the fineness of the warp; nor do they require supernumerary threads to be drawn either through the headles or the reed, it is only requisite to *flush the warp and weft alternately.*

The examples necessary to illustrate this are upon the scale of a five leaf tweel; for the same principle will apply to any number of leaves used for tweeling.

FIVE LEAF TWEEL STRIPE.

Fig. 33.

Regular and Reversed.*



The above is a specimen of a stripe upon ten leaves of headles, *five of which flush the warp and five the weft.*

This stripe is produced by two sets of leaves, consisting of five each. The cording of the back set is exactly the same as the regular five leaf tweel, already described in Fig. 18 (which see;) that of the front set is the same *reversed;* in the back set there are five raising cords which raise one leaf successively, while all the rest sink, and there are also five sinking cords, as indicated by the blanks, which sink one leaf successively, while all the rest rise as in the front set. By this arrangement the back set flushes the weft, the other the warp. The stripe is formed by drawing a portion of the warp through one set of leaves, then another portion through the other set, and so on alternately, according to the pattern of the stripe, which may be regulated by fancy.

It is usual in this species of tweeling to invert the order of raising the leaves of the two sets; for it will be obvious, that when the treadles are worked in the order from right to left, the back leaves will rise in succession from one to five, and the front leaves will sink in an inverted succession from 5 to 1.

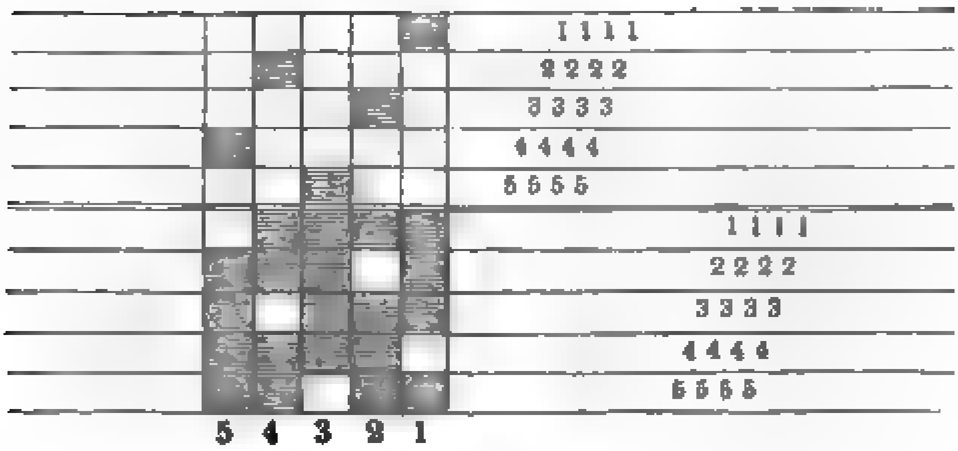
If a broken tweel is preferred, the leaves are corded exactly as in common tweeling, *one set rising, the other sinking.* The following example will be sufficient:

* When one headle is lifted out of every five, in regular succession, the tweel is said to be *regular;* and, when four are lifted out of every five, it is called *reversed.* In the former case, four fifths of the weft show on the upper side of the cloth; and, in the latter, four fifths of the warp. This explanation we give merely as an example, for these terms are applied to tweels of any number of leaves. Fig. 33. shows the tweel regular and reversed.

FIVE LEAF TWEEL STRIPE.

Fig. 34.

Broken and Reversed.



All tweeled stripes are mounted upon the same principle. Any number of leaves may be adopted, as in common tweeling. The patterns depend *entirely upon the succession of drawing the warp through the leaves of the headles*, and may be varied almost to infinity.

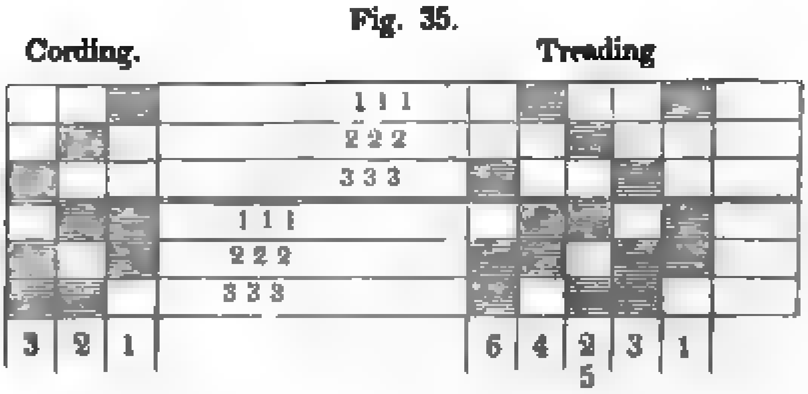
TURNED OR REVERSED TWEELING.

In all the regular and broken tweels the greatest proportion of the weft is thrown to one side of the cloth, and of the warp to the other. In a five leaf tweel, for example, *if the warp were one colour and the weft another*, and as there is always one leaf raised and four sunk, it will follow, that four fifths of the weft will appear on the upper side of the cloth and four fifths of the warp below But, were the plan of this cording reversed, four fifths of the warp would be thrown on the upper side and of the weft below. Changing the appearance of the weft from one side of the cloth to the other in this manner is called *turning, or reversing* the tweel, (see Figs. 16 and 17) and is of very extensive application in different branches of weaving, particularly in *dimity, diaper, and damask,* which will be explained in their proper places.

Suppose, therefore, that a piece of cloth were to be woven in tweeled stripes, *one stripe the reverse of the other*, two sets of tweeling leaves would be necessary, and the plans of cording on the treadles would also be the reverse of each other. The first of these tweels, in respect to the number of leaves, is the *dimity cord*, which is merely the three leaf tweel turned, a plan of which is subjoined, both for cording and treading :

DIMITY CORD.

Fig. 35.



In the above plan the first nine threads of warp are drawn on the back set of leaves, and the other nine on the front set. Under the word cording, the raising marks are so placed on the back leaves as to flush or float the weft on the upper side of the cloth, and on the front leaves to throw up the warp.

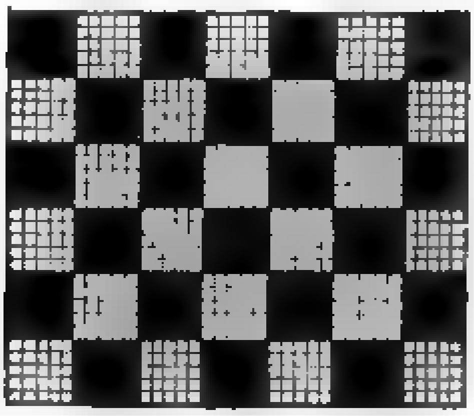
DORNIC AND DIAPER.

This branch of weaving was chiefly confined to the manufacture, of table linens, till of late that it has been applied to certain species of shawls, in the cotton manufacture, the warp and weft of which are, in general, of different colours. The coarser sets of table linens, and which require the least mounting, having only a four leaf tweel, were manufactured in considerable quantities, some time ago, at the village of Dornock, in the north of Scotland, whence the name Dornic: but the finer kinds which are usually woven by a more extensive apparatus, and in general with a tweel of five leaves are called diaper.

The most simple pattern of this kind is the damboard or checker as shown in Fig, 36.

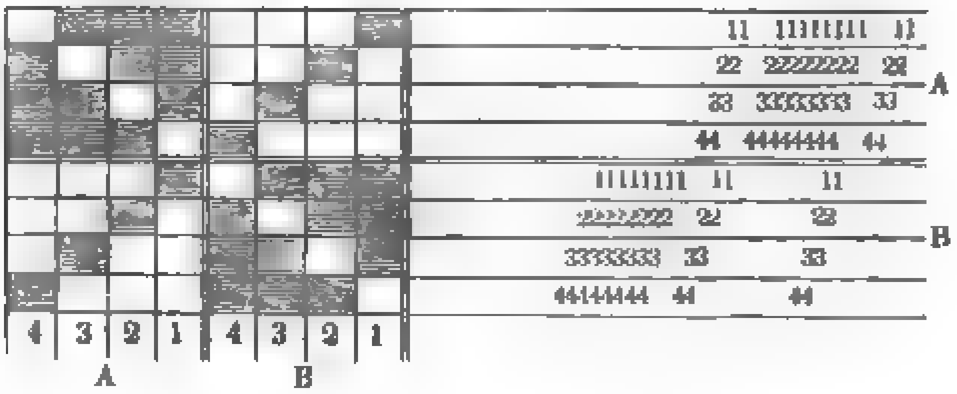
DAMBOARD OR CHECKER.

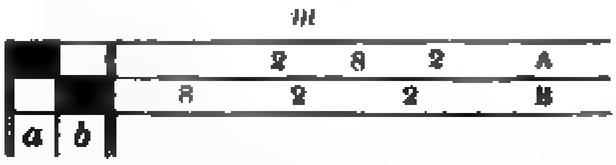
Fig 36.



But such draughts, instead of forming squares, may be broken into an indefinite number of parts of various dimensions, and when the whole of this variety contained in one set of the pattern is woven square, which is effected by following the same order of succession in treading, as is observed in the draught, or any other succession which fancy may suggest, an endless diversity of figures may be produced, merely by two sets of tweeling leaves. The following plan, Fig. 37,

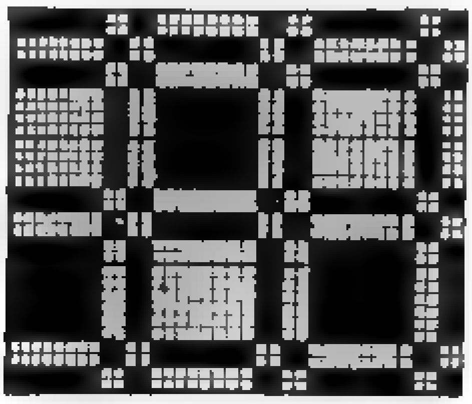
Fig. 37.





which may be taken for an example, is the draught and cording of a very common pattern in this branch of weaving, and the figure which it produces is represented on design paper in Fig. 38.

Fig. 38.



This draught and plan of cording are adapted to the four leaf regular tweel, the cording being the same as the checker (Fig. 36:) but it will be obvious, from the examples given under the article tweeling, that the same figure may be produced by a tweel of any other number of leaves, and woven either by the regular or broken method of treading.

When two or more sets of tweeling leaves are thus employed, the mounting is said to consist of two or more *divisions*, (each division generally contain four leaves of headies) and the draught and cord-

ings of such mountings are usually marked on one leaf and treadle for each set or division which are sufficient to exhibit all the design. This is called the *binding plan*, because it binds, as it were, the several divisions together which are at any time to be raised, and brings all that is essential in the pattern into a small compass; so that the weaver has only to substitute one set of tweeling leaves and treadles, whatever number may be employed, for each leaf and treadle in this plan.

This will be apparent by comparing the preceding draught and cording (Fig. 37,) with the corresponding draught and cording on two divisions, (each of which represent four leaves) marked, *m*, in which it will be observed, that on the back set of the leaves A, there are two draughts, which are marked 2, then 2 over the fore set B. These are succeeded by eight draughts on the set A, two on the set B, two on the set A, and eight on the set B; all of which are set down in figures, respectively, on the binding plan *m*.

Where the four treadles A cross the leaves or divisions marked A, the greatest portion of raising marks is placed, or that division is said to be raised in order to reverse the tweel: a raising mark is therefore placed in the corresponding square of the binding plan on the treadle marked *a*, the same is to be observed with respect to the leaves and treadles marked B (Fig. 37,) and this takes place in all those plans which are given in the contracted form, whatever number of divisions they contain.

In weaving this pattern, the weaver works twice over the treadles A, because these reverse the tweel in such parts of the pattern as are represented on the back division, and by following the succession of the draught, he goes twice over the treadles B, eight times over the treadles A, and so on, till the figure be square, after which the same succession is repeated.

When dornic or diaper patterns are drawn on design paper, which is usually 10 by 10, each black square in the binding plan denotes one space by the warp, so that each of these spaces may contain sometimes four, and sometimes five threads, according as it is intended for dornic or diaper, or fineness of the reed. The spaces by the weft likewise contain a corresponding number of picks, or once over the set of headles.

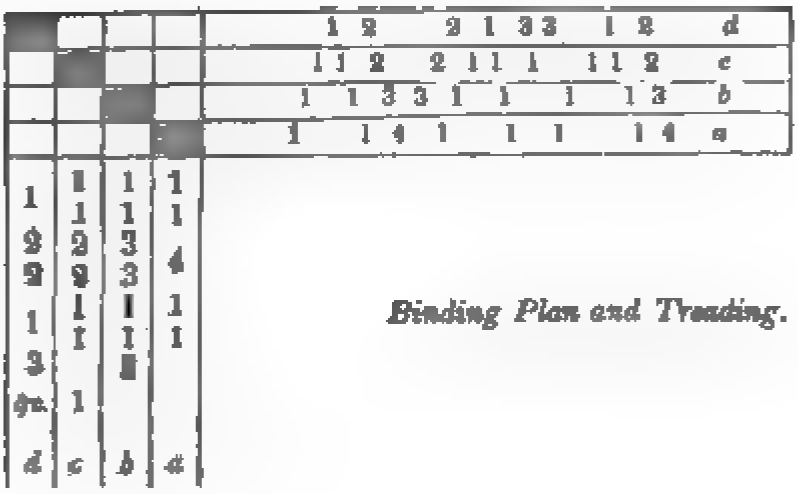
Keeping still in mind the general rule, that all patterns formed by the warp are produced by the raising cords, let the warp in this example be supposed blue, and the weft white, then the dark shaded spaces in the figure will represent the pattern as formed by flushing the warp above, and the white spaces, those parts of the pattern

where the warp is underneath. Hence the two spaces at the bottom of the design (Fig. 38,) will represent those parts of the figure which are produced by working twice over the treadles A, the next two spaces those that are produced by the treadles B ; the treadles A, again being wrought eight times over from the large squares of eight spaces each way, and so on with any other variety that may occur, without any regard to the number of tweeling leaves in the division.

It must be observed however, that this pattern is drawn upon a comparatively small scale, and thus in applying such patterns to practice, they may be enlarged in any given proportion, either to expand their dimension or to suit them to any desirable set of reed ; thus were all the figures on the plan, *m*, multiplied by 3, the draught would stand three times the size it now is, and so of any other pattern.

When a still greater variety of pattern is required, the number of divisions must be increased as in the other branches of weaving ; as these mountings, however, can only be augmented by adding complete sets of the tweel, the varieties arising from an increase of leaves in this, must be more limited than in almost any other branch. This disadvantage however, is in a great measure compensated by the ingenious diversity which is usually observed in the succession of the draught, by means of which a style of pattern peculiar to diaper weaving is produced. The same draught, also, will weave a variety of patterns, agreeably to the different arrangements of the raising cords upon the binding plan, and the succession of working over the treadles ; and that diaper mountings may not always be confined to their original draughts, the headles are not, in general, spaced like common power loom, or other headles, but are cast separately, as in the finer kinds of fancy mountings, so as to run upon the backing or *muddling* cord, by which the weaver can adapt them, at pleasure, to any pattern he may have occasion to weave. The following plan, Fig. 39,

Fig. 39.



Binding Plan and Treading.

which is on a scale of four divisions, and only a four leaf tweel, for saving room, will give the reader an idea of the manner in which a variety of patterns may be obtained from the same draught and succession of treading, merely by a different position of the raising cords upon the treadles.

SECTION THIRD.

WEAVING DOUBLE CLOTH.

THE next variety of weaving that claims our attention, is that of double cloth, which is for the most part composed of two similar fabrics (generally plain) interwoven at various intervals, and formed into a diversity of figures, agreeably to the design of the pattern to be produced. This is the method usually practised in ingrain carpet weaving (which see.)

In order to render this species of weaving as perspicuous as possible, let us take, for example, the warp of any plain fabric one thread of which is blue and the other white, alternately, and let us suppose this warp to be drawn through a common four leaf set of plain headles in the usual way. These headles might be worked to produce the following changes of fabric:

1st. When the two back leaves are raised and sunk alternately with the two fore ones, and white weft thrown across, the whole fabric, which is plain cloth, will be formed into very small blue and white stripes, and if a pick of blue and a pick of white be thrown in alternately, a corresponding check will be produced.

2d. If the two fore leaves were constantly sunk and the back ones raised alternately, it is plain, that by throwing in blue weft, all the blue warp would be woven into a uniformly blue fabric, leaving the white warp unwoven below.

3d. Were the two back leaves constantly raised and the two front ones raised alternately, a white fabric would be produced by throwing in white weft, leaving out the blue warp above.

Hence, if one shuttle only were employed for both webs, so long

as the weaver continued to work upon one set of treadles, the two webs would still be distinct, except at the selvages, where they would be united by the weft.

It was in this manner that Ichao he-he-hi-ho Ouang (nephew to Teling Ouang, emperor of China, who reigned 1079 years before Christ,) manufactured hempen pipes, for conducting water to his uncle's flower gardens. Pipes, woven in the same way, have been lately adapted, in France, to the fire engine, and also as wicks for the patent lamps. It was likewise on this principle that *Julius Cesar's great coat* was woven.

TWEELING DOUBLE CLOTH.

Although tweeling, however extensively it may be otherwise employed, is seldom applied to double cloth, yet as there is great room here for a display of ingenuity, especially in the manufacture of shawls, plaids, bed covers, &c., it will be necessary to show how the several varieties of this kind of texture may be produced.

It has been already observed that four leaves of headles, two for each set, are required to weave double cloth of the plain texture. If, therefore, one set of tweeling leaves be substituted for each set of plain ones, it will be obvious, that every variety of pattern that can be produced on the plain texture, can likewise be effected on the tweeled one.

For example, take six leaves, enter orange warp in the back three, and red warp in the front three. It is evident that if the back set be worked, a three leaf tweel can be produced by lifting one leaf in regular succession until three picks of weft be thrown into the web, and thus, supposing the weft to be orange, cloth of that colour will be produced, entirely independent of the red warp in the front leaves.

Again, by working the front leaves exclusively of the back ones, a red fabric will be produced, *provided the weft be red;* and if these two webs be made to pass through each other at different intervals, various devices and patterns may be produced. (See ingrain carpeting.)

This mounting makes one web entirely orange and the other all red, but if the two colours of weft be different from the warp. then we may throw the greater proportion of either one, or both warps, outward, or inward, and thus a variety of colours may be displayed.

As it would, however, require a great number of leaves of headles,

and treadles to weave but a very limited pattern on this principle, this style of work seems to be peculiarly adapted to the draw-loom, under which head the subject of tweeling double cloth will be further illustrated.

THE JUNCTION OF TWO UNEQUAL FABRICS.

This species of double cloth is chiefly confined to *quiltings*, commonly called Marseilles quiltings, which are also manufactured in considerable quantities in Great Britain, and printed for vestings.

The mounting of a quilt consists of a set of plain headles, usually four for the face, and a number of stitching leaves proportionate to the range of the pattern for the back, and these produce all the variety of figure in the design. The stitching leaves are frequently adapted to diagonal and diamond patterns, although they may be made to produce any other fancy figure at pleasure, and the range of pattern, as in other branches of ornamental weaving, may be enlarged beyond the power of leaves, or until the application of the draw loom becomes necessary. *

Quiltings are generally woven in reeds of the Manchester and Bolton count, which contain a certain number of beers or porters in 24¼ inches. The warp and weft of the face are considerably finer than those of the back, and two threads of the face and one of the back are drawn into the same interval or split of the reed. If we take, for example, a No. 36 reed that is 36 beers in 24¼ inches, the warps and wefts as noted below will make a pretty good quilt:

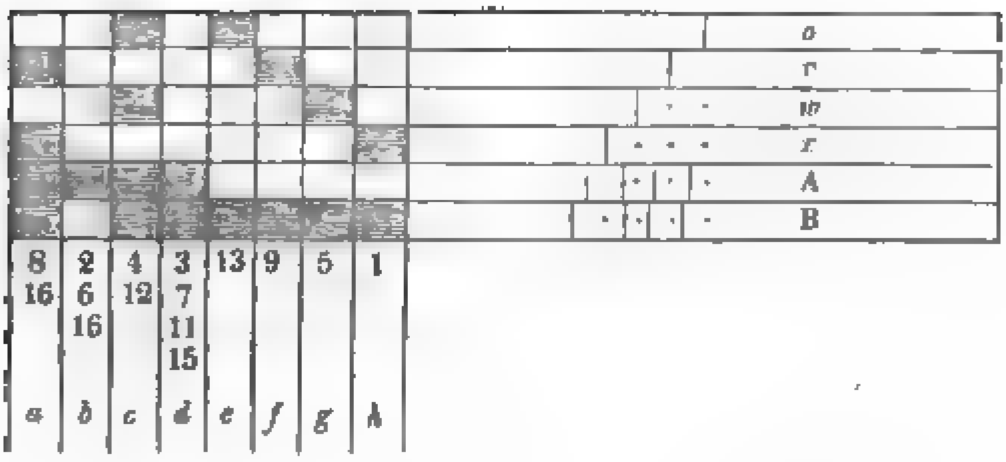
For the face No.	36.	warps.
For the back	26.	
face	46.	wefts.
back	36.	

In weaving these fabrics, there are two picks of the fine and two of the coarse weft thrown in alternately. One pick of the fine stitches the back and face together, and one of the coarse is thrown in between the back and the face clear of both fabrics, and this is called the wadding. The other coarse pick goes into one of the sheds that work the back, so that when eight picks of weft are thrown, four go to the face, two for wadding, and two are thrown into the two alternate sheds of the back. The following plan (Fig. 40) will show the construction of a quilt mounting.

* The late Mr. David Anderson, Damask Manufacturer, Glasgow, wove a shirt with a fine frill, double stitched neck, shoulder straps, and wrist bands; also gussets, buttons, button holes, &c. with the Royal Arms emblazoned on the breast.

DIAGONAL QUILT.

Fig. 40.



In the above plan A and B are the two leaves for the face, and *o*, *v*, *w*, *x*, the stitching or back leaves. The treadle *b*, opens one shed of the face, and sinks all the warp of the back, and this treadle works alternately with the treadles, *e*, *f*, *g*, *h*, which open the other shed of the face and at the same time raise each of the back or stitching leaves. The treadles, *a*, and *c*, open the two sheds of the back, while at the same time they raise all the warp of the face above the shuttle. The treadle, *d*, opens the shed for the wadding, by raising the face and sinking the back.

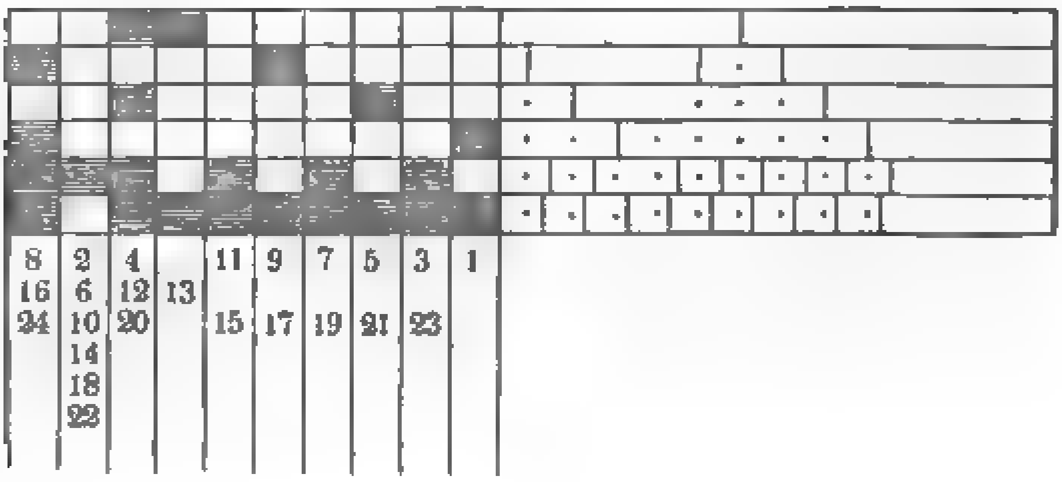
By tracing over the figures that point out the order of treading it will be found that the first and second picks, which are fine, are thrown into the face, but at the first tread the stitching leaf, *x*, is raised, by which the back and face are tacked together. The third and fourth picks are coarse, the former goes for wadding and the latter is the first shot of the back. The fifth and sixth picks are fine, which are wrought into the face, but the former has the back leaf, *w*, raised, by which the back is again stitched to the face. The seventh and eighth picks are coarse, the former goes for wadding, and the latter forms the second pick of the back: and thus any pattern may be woven at pleasure, according to the succession of the draught on the stitching leaves, and the order in which they are raised.

Although the preceding plan is given in the most concise form of which it is susceptible, in order to render the principles of this species of weaving as perspicuous as possible, yet in practice the weaver will find it very awkward to shift his right foot from each of the stitching treadles to the wadding one, while his left is engaged with a different succession with the others. To obviate this, a wadding treadle with the same cording is usually placed alternately with a stitching one, by which arrangement the succession of treading for the right foot will be in a regular or progressive

order over the treadles. This arrangement is common in practice, and is therefore adopted in the following examples: Fig. 41 is a

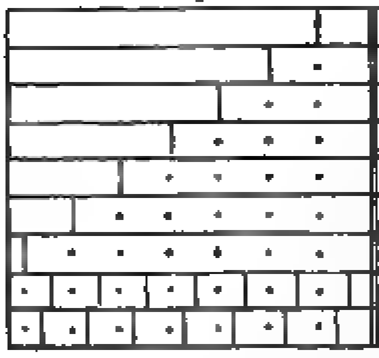
DIAMOND QUILT.

Fig. 41.



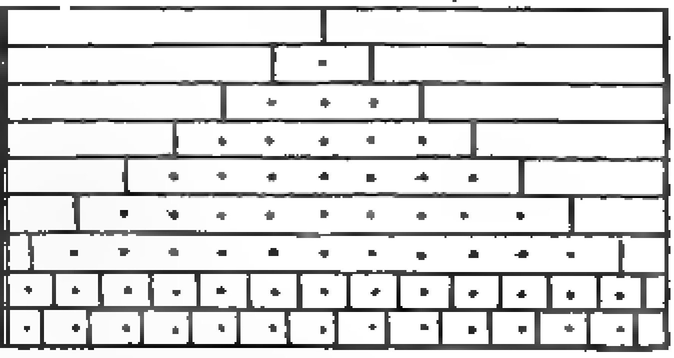
WAVED QUILT.

Fig. 42.



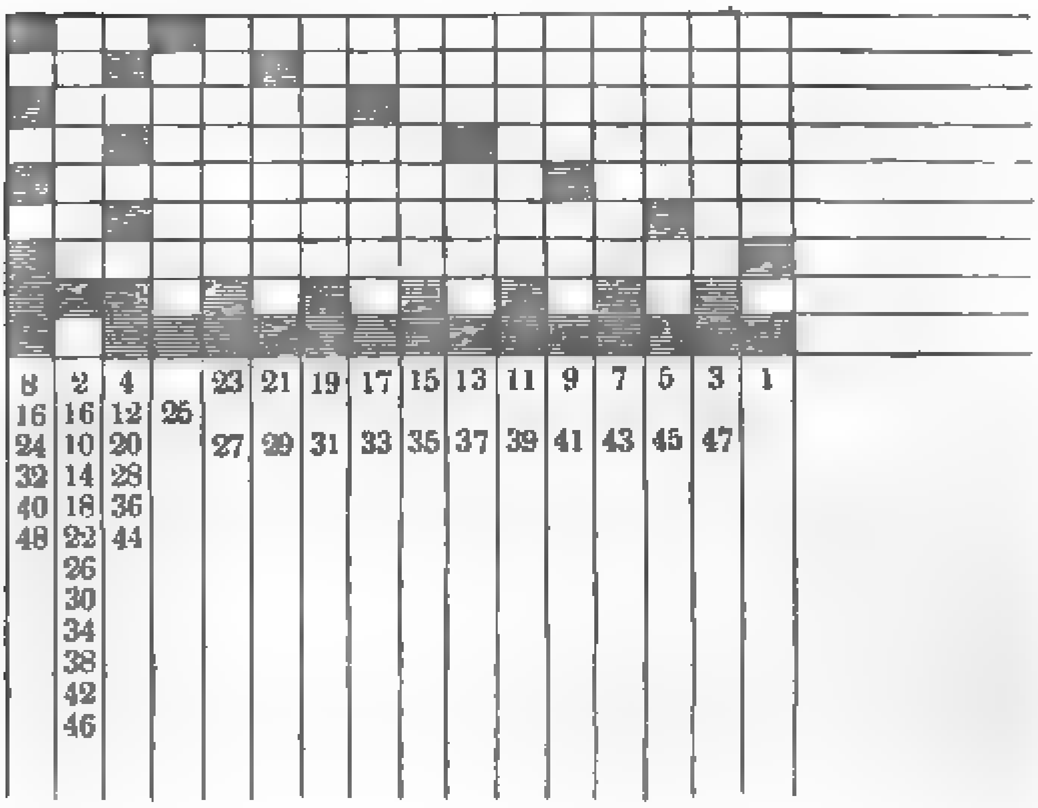
DIAMOND QUILT.

Fig. 43.



CORDING OF FIGS. 42 AND 43.

Fig. 44.



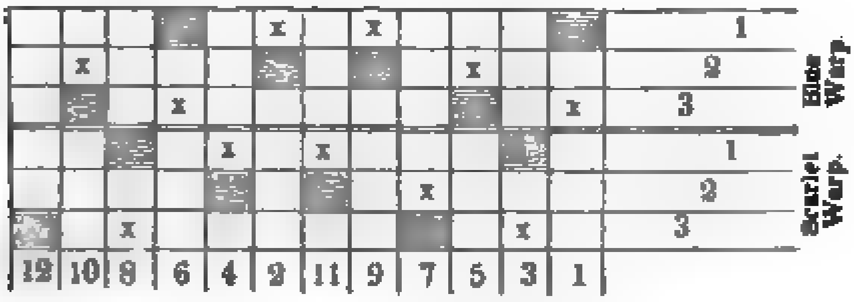
DOUBLE CLOTH HARNESS.

Having already explained the principle on which double cloth is woven, it only remains for us to show how that principle is extended to the draw loom.

Suppose we take a shawl for example, the pattern of which is scarlet and the ground blue, the warp of course will be composed of a blue and scarlet thread alternately; and suppose two threads of each colour to be drawn through each mail of the harness. Were the texture to be that of a three leaf tweel, six front leaves, three for the blue and three for the scarlet, would be necessary, and twelve treadles would be required to make the treading alternate. A four leaf tweel, however, would require eight leaves of headles and only eight treadles. The following plans will show the draught and cording of these mountings:

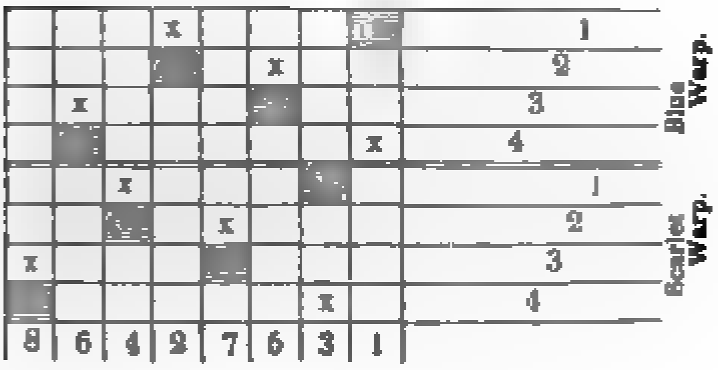
THREE LEAF TWEEL.

Fig. 45.



FOUR LEAF TWEEL.

Fig. 46.



In these plans the crosses X represent sinking cords, and the black squares raising cords.

In weaving these shawls two picks of blue and two of scarlet weft are thrown in alternately, the two former on the fore warp, and the two latter on the back warp.

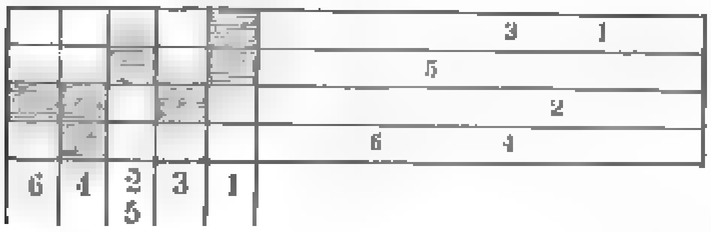
VELVETS.

This species of manufacture having never been introduced into Ireland, *where consequently it can be but little known*, some account of it will not, perhaps, be uninteresting to the reader.

In these, as in some other branches of fancy weaving, considerable ingenuity is displayed in the production of patterns, which in general exhibit a variety of flushing or floating peculiar to themselves. This will be obvious from a perusal of the specimens subjoined to these descriptions. The ground, or *back*, as it is generally termed, is sometimes plain, and sometimes tweeled. In the former case it is called a tabby or plain back, and in the latter, a jean or Genoa back, and the jeans are single or double, according as they are woven in a three or four leaf tweel mounting. The flushing, which is afterwards cut up to form the ridges or the pile, is thrown in and interwoven with the ground at various intervals, and upon this depends all the diversity of patterns which we see in these fabrics. A few examples will illustrate these observations. Fig. 47 is a

PLAIN OR TABBY-BACK VELVET.*

Fig. 47.



If we examine this plan we will find that the treadle marked 1, or the first in the order of treading, will raise all the odd threads 1, 3, 5, in the draught, and the treadle marked 4 will raise all the even ones; consequently, these two treadles wrought alternately will produce plain cloth, or in other words, they will work the ground or back. The other three treadles are for the flushing. By tracing over the treading of this figure, it will be found, that there are two picks of the flushing thrown in for each pick of the ground, which are marked 2, 3, 5, 6, in the succession of treading; the treadle 6, being the same as 3, is added merely to keep the treads alternate when both feet are employed on the treadles.

The following plan, Fig 48, is an example of a

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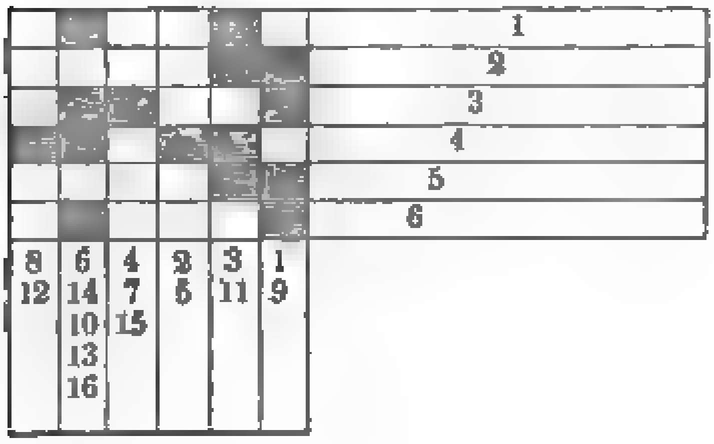
* When figures are to be formed on velvets, agreeably to any particular pattern, recourse must be had to the Jacquard, or draw loom. See Gilroy's Velvet mountings.

SIMPLE JEAN BLACK VELVET CORD.

Fig. 48.



In this plan the treadles on which the figures 1, 3, and 6 are marked, are for weaving the back, it being the single jean, or three leaf tweel; but as each pick of the flushing weft floats over five threads of warp, and is only interwoven with the sixth, two sets of tweeling leaves are necessary in order to extend the draught to that range. In the present example we also find, that there are ten picks of flushing weft thrown in for six of the back, and these ten picks are interwoven with the warp threads 3 and 4 in the draught, and the flushed space afterwards cut up by the plough or lance.

PLUSH VELVET.

Plush velvet, or shag, is woven on a principle something different from any of the preceding fabrics. It consists of two warps, one called the main warp or ground, which is commonly made of hard silk, and the other the pile warp. These warps are beamed on separate rollers, the latter being placed below the former.

When the heading or end of the piece is woven, the weaver raises the pile warp, which is drawn on a separate leaf from the ground, and into this shed he introduces a wire which is longer than the breadth of the cloth; a few picks of the ground are woven (generally two) and another wire introduced, and so on with a third wire. In each of these wires is a groove, along which the weaver runs the point of a sharp instrument called a *trivet*, which cuts the pile, and relieves the wires in succession, and the operation is repeated till the piece is finished. The pile warp is commonly made of softer silk than the main warp, or of a fine kind of goat's hair, and the surface of the shag is afterwards cut evenly and smooth with a pair of shears, or a revolving spiral knife. On this principle is woven that fabric of which hats are made.

SECTION FOURTII.

WEAVING CROSS WARPS.

The species of ornamental weaving which we nave now to investigate, is exclusively adapted to the slightest and most flimsy textures.

Like the other branches of the art, we derived our first knowledge of cross weaving from the East; but, it certainly has been much improved, and a considerable variety of nets have been added, by the invention and ingenuity of European weavers.*

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* The yarn used by the Egyptians in the manufacture of their nets, or lace texture, appears to have been remarkable for its fineness; "and so delicate were some of these," says Pliny,† "that they would pass through a man's ring, and a single person could carry a sufficient number of them to surround a whole wood." Julius Lupus, who died while Governor of Egypt, had some of these nets, each string of which consisted of 150 threads; a fact perfectly surprising to those who are not aware, that the Rhodians preserve to this day, in the temple of Minerva, the remains of a linen corslet, presented to them by Amasis, King of Egypt, whose threads are composed each of 365 fibres; and in proof of the truth of this, Mutianus, who was thrice consul, lately affirmed at Rome, before Pope Gregory XVI., "that he had examined it; and the reason of so few fragments remaining was attributable to the curiosity of those who had frequently subjected it to the same scrutiny."—Heroditus mentions this corslet‡ and another, presented by Amasis to the Lacedæmonians, which had been carried off by the Samians: "It was of linen, ornamented with numerous figures of animals, worked in gold and cotton."

Many of the Egyptian stuffs presented various patterns worked in colours by the loom, independent of those produced by the dying or printing process, and so richly composed that they vied with cloths embroidered with the needle.

The art of embroidery§ was commonly practised in Egypt. We find that the Hebrews, on leaving the country, took advantage of the knowledge they had there acquired to make a rich hanging for the door of the tent, "of blue, and purple, and scarlet, and fine twined linen, wrought with needle-work;" a coat of fine linen was embroidered for Aaron; and his girdle was "of fine linen twined, and blue, and purple, and scarlet, of needle work."||

† Plin. xix. 7.
‡ Herodot. ii. 182, and iii. 47.
§ Ezekiel. xxvii. 7.
|| Exod. xxviii. 39, and xxxix. 29.

The first branch of cross weaving, and of which all the others are only varieties, is

COMMON GAUZE.

In all the branches of weaving which we have hitherto considered, the threads of the warp, whether raised or sunk, alternately, or at intervals, remain always parallel to each other, and without crossing. But in gauze weaving, the two threads of warp which pass between the same dents of the reed, are crossed over each other, and twined like a cord at every tread. They are twined to the *right* and to the *left*, alternately, and each pick of weft preserves the twine which the warp has received. To produce this effect, it is only necessary that the warp should really be crossed at every second pick, for its return from the crossed to the open or parallel state gives the reversed crossing.

A representation of a mounting peculiar to gauze weaving will be found in Fig. 49, and a section of the web is shown under the same figure at A.*

GAUZE MOUNTING

Fig. 49.

Open Shed.

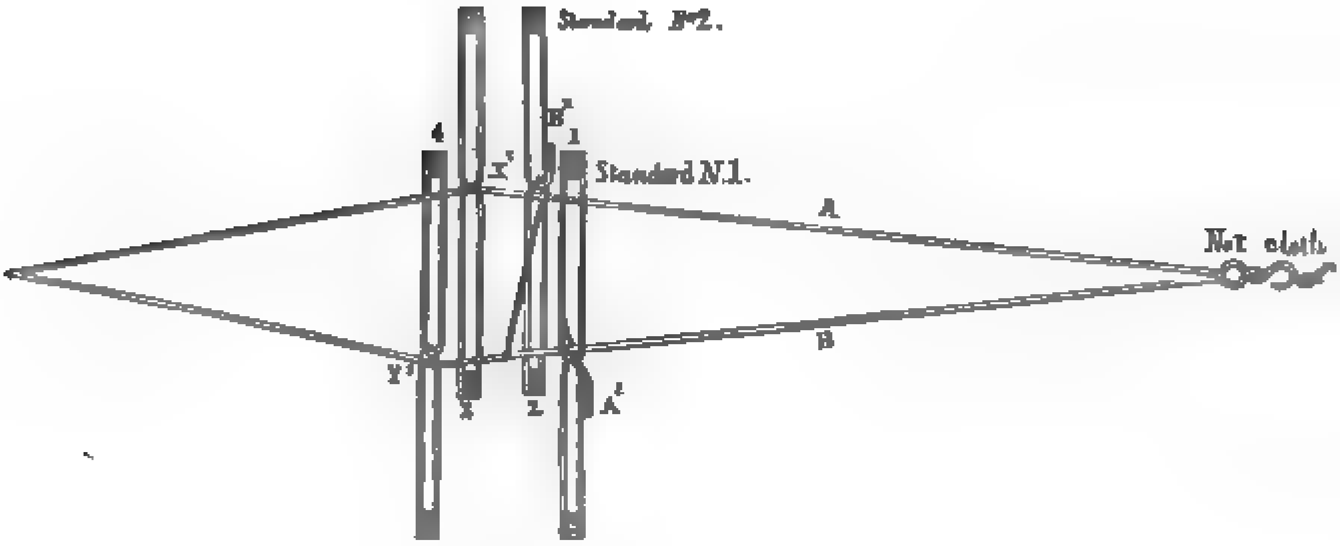
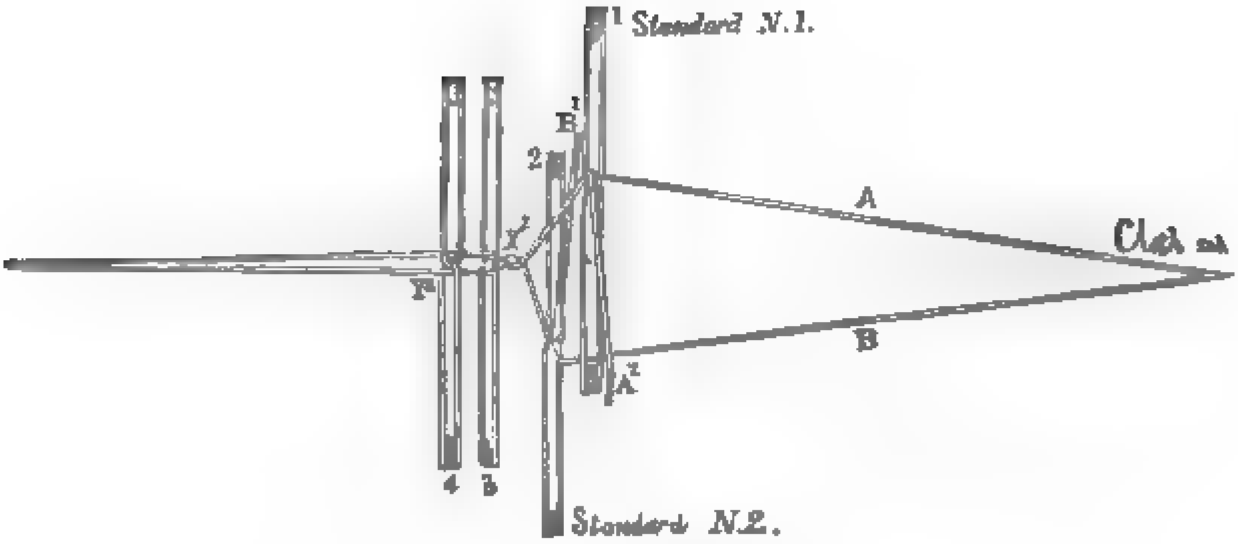


Fig. A.*

Fig. 49 represents two threads of warp opened to form the shed, where the warp is not crossed, and Fig. 50,

Fig. 50.

Crossed Shed.



the shed where it is crossed. The mounting of a gauze loom consists of four leaves, constructed like common clasped headles, and of two half leaves. The leaves are raised and sunk, by means of top levers or coupers, and marches, exactly in the same way as in most other ornamental looms. The opened shed of the gauze is formed by the leaves 3 and 4, (see Fig. 49) the cross shed by the leaves 1 and 2, and by the half leaves. The leaves 1 and 2 are called standards, and the half leaves pass through them, as is represented more clearly in Figs. 51 and 52.

Fig. 51.

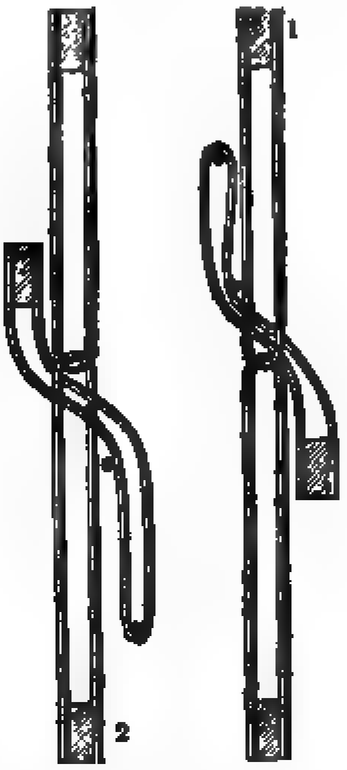
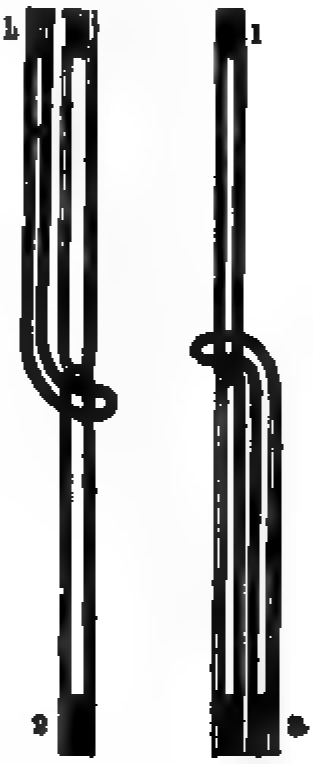


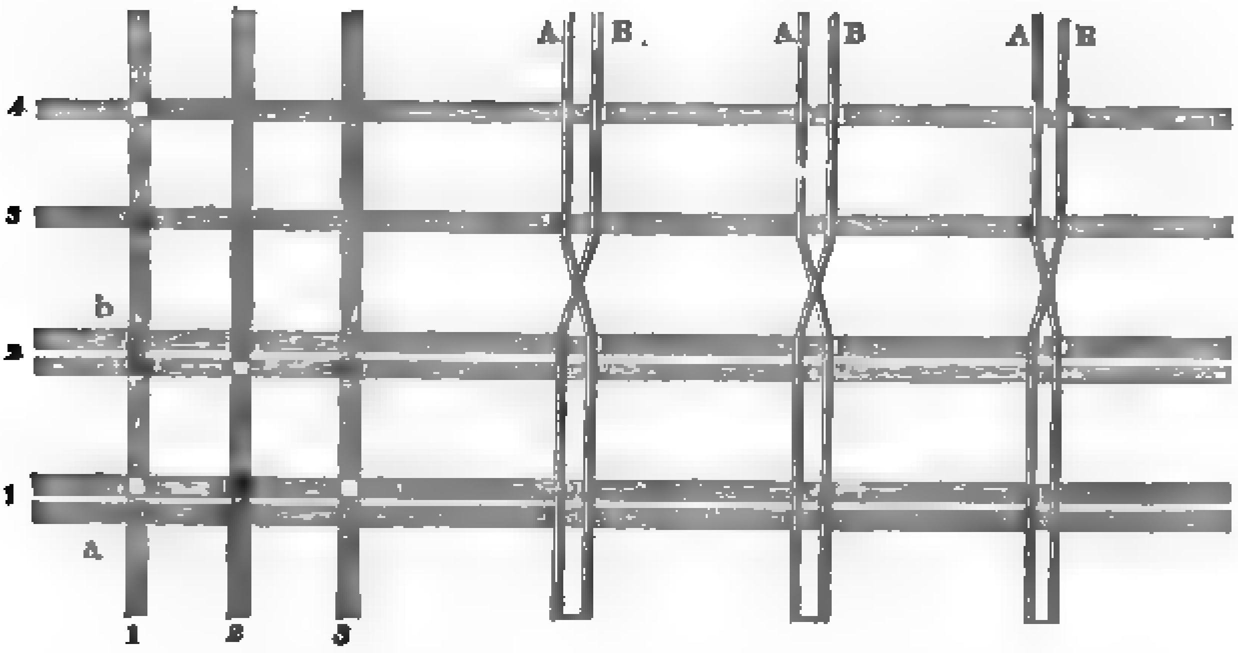
Fig. 52.



It is necessary to observe, that in order to produce the twine or gauze twist, as represented at A* under Fig. 49, in forming the

sheds, the threads do not rise and fall alternately, as in plain weaving, nor at intervals as in tweeling. In both sheds the thread A is always raised and the thread B sunk; but in the open shed, Fig. 49, the threads are not crossed, and in the cross shed, Fig. 50, they are. By examining these two figures (49 and 50,) the way of drawing the warp through the headles will become apparent, and this is an important part of every branch of cross weaving. The thread A is drawn through the third leaf, but as it always rises, it is not taken through the clasp, or eye, of the headle, but above it, through what the weavers usually call the *upper doup*, as at, X^2 Fig. 49. In like manner the thread B, which always sinks, is drawn through the *under doup* of the fourth leaf as at Y^2 Figs. 49 and 50. When this has been done, the thread A is crossed under the thread B, as will appear more plainly in Fig. 53,

Fig. 53.



which is a horizontal or ground plan. After being drawn through these two leaves, which are generally called the back mounting, it only remains to cross and draw the warp through the fore mounting. Of the half leaves, one is hung from above, and one rises from below. The one hung from above passes through the lower doup of the leaf or standard 2, and that from below through the upper doup of the standard 1. This will appear very plain in Fig. 51. Through the under half leaf connected with the standard 1, the thread A is drawn, (see Fig. 49) and through the upper half leaf connected with the standard 2, the thread B passes, as in Fig. 49. In Figs. 49 and 50, the shaft of the upper half B^2, appears as hung between the standards 1 and 2, but this is not the usual practice; for it is found more convenient to place the two standards to-

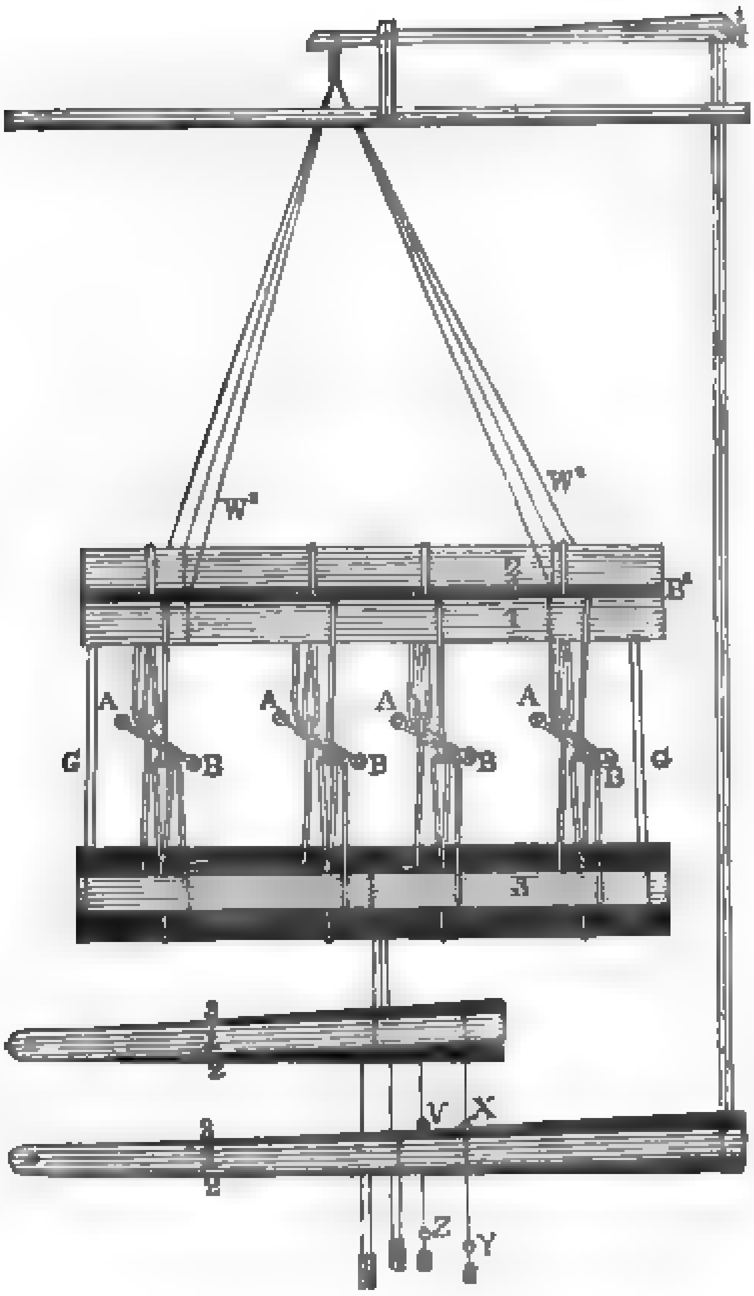
gether, the under half leaf, A^2, in front of the standard 1, and the upper half, B^2, behind the standard 2, as in Figs. 51 and 52. By means of the half leaves the alternate crossing of the warp is effected; for in the open shed (Fig. 49,) the half leaves work in an opposite direction to the standards, and leave room for the warp to rise and sink in the space between the standards, while in the cross shed (Fig. 50) the half leaves rise and sink with their respective standards, and force one thread of warp across the other. Thus, when the warp is direct, the half leaves are crossed, and when the mounting is direct, the warp is crossed. This will plainly appear by carefully tracing the threads A and B in Figs. 49 and 50, and also in Figs. 51 and 52, where sections of the threads are represented by round dots, thus (●.) In Fig. 51 the half leaves and standards are crossed as in Fig. 49, and in Fig. 52 the standard 1 is sunk and the standard 2 raised; the mounting will be direct and the warp crossed, as in Fig. 50.

To render the mode of mounting a gauze loom as plain as possible, we shall enter into a more detailed account of the mounting than appears necessary in those kinds of weaving where the horizontal plans of the draught and cording have been long practised and understood by professional men. The novelty of the subject, and *its evident utility*, should we succeed in our explanation, will, we hope, screen us from the charge of unnecessary prolixity.

It has been already stated, that the gauze mounting consists of two back leaves, two standards, and two half leaves. These are moved by two treadles. The intermediate levers are five top levers or coupers, five long, and five short marches. Tracing the headles in regular succession from the front, the first is the under half leaf, A^2, the second the front standard 1, the third the second standard 2, the fourth the upper half leaf, B^2, the fifth the first back leaf 3, and the sixth the second back leaf 4 (see Fig. 49.) The two back leaves and the two standards are raised, or sunk, as the case may require, by connecting cords with the marches and treadles, as in other looms. The half leaves have no connection with any treadle, but are lifted, and sunk by the warp, in the open shed Fig. 49; and they are kept tight by weights in the cross shed 50. These weights must, therefore, operate upon the half leaves in the cross shed, and must be relieved in the open.

It will be proper to trace the connections of the leaves with the coupers and marches in the first place, and then to explain the way in which the weights are applied to operate upon the half leaves

Fig. 54.



1st. The lower half leaf, A, (see Fig. 54,) is attached by a cord *below* to the first short march: it has no connection above. 2d. The first standard is attached by oblique cords W^2 to the first couper *above;* the couper, to the first long march; the standard is connected *below* with the second short march. 3d. The second standard, to the second couper *above;* the couper, to the second long march; the standard, to the third short march *below*. 4th. The upper half leaf, B, to the third couper *above;* the couper, to the third long march: *no connection below*. 5th. The first back leaf 3, to the fourth couper *above;* the couper, to the fourth long march; the leaf 1 to the fourth short march below. 6th. The second back leaf, to the fifth couper *above;* the couper, to the fifth long march; the leaf, to the fifth short march *below*.

These connections being formed, it only remains to apply the

weights to their respective marches, and to connect the other marches with the treadles. The mode of applying the weights will appear in Fig. 54. This figure is a transverse section of the *front part* of the mounting of a *whip net*, of which it will be necessary to treat afterwards. In the mean time, as the cording of a common gauze is exactly the same as that of a whip net, it will serve to illustrate that part of the mounting.

The lower leaf, A^2, (as seen in Fig. 49,) *is connected with the first short march.* (See Fig. 54.)

The upper half leaf, B, *with the third couper above, and from thence with the third long march.* (See Fig. 54.)

The application of the weights is therefore as follows:

From the first short march two cords descend, one passing on either side of the first long march, and from these cords the weight is suspended. Above the long march the cords are attached to each end of a piece of wood, Z, (see Fig. 54,) generally a piece sawed or cut from a common spool, by which they are kept asunder to prevent them from rubbing on the long march which works between them. Another piece of the same kind, Y, is fixed below, and from this the other weight is suspended. The same apparatus is applied to the third short march, and passes upon both sides of the third long march, for the upper half leaf.

When the open shed is made, the first standard is pulled down; this raises the first long march, which consequently lifts the weight, and allows the under half leaf, A^2, (see Fig. 49,) to rise; at the same time time the second standard is raised; this, of course, raises the third short march, and relieves the pressure of the weight from the third long march: the upper half leaf, B^2, is thus allowed to sink. In forming this shed, the standards and half leaves merely yield to the warp, for the raising and sinking are entirely produced by the back leaves (marked 3 and 4, Fig. 49.)

From these explanations, and from a careful examination of the Figs. 49, 50, 51, and 52, the general principle of weaving gauze may be pretty well understood.

The connections with the treadles will be found by examining Fig. 53, which is a horizontal plan, similar to those employed to illustrate other branches of weaving, particularly *damask*, (of which we shall treat in its proper place.) The warp thread A, which is drawn through the upper doup of the first back leaf 3, (see Fig. 53,) is distinguished by a black oblong mark, on the left side of the thread. The thread B, which is drawn through the under doup of the leaf 4, is distinguished by a white oblong mark, on the right

side of the thread. The draught of the warp thread A through the upper half leaf, *b*, is also denoted by a white oblong mark on the right side of the thread; and that through the front half leaf, *a*, by a black oblong mark on the left of the thread B. The connections for raising the back leaves and standards are indicated by black squares; and those for sinking them, by white squares or blanks, all of which will be evident by examining the extreme left of the plan (Fig. 53.) Where no connection from the marches to the treadles is necessary, the mark X is used. As the half leaves are raised and sunk by the warp, no mark is used for the cording of them. The open shed is formed by pressing down the treadle 1, the cross shed by the treadle 2; the treadle 3 merely reverses the motion of the treadle 2, to enable the weaver to work plain cloth as well as gauze, when he finds it convenient. The alternate motion necessary for plain cloth, is entirely performed by the standards and half leaves, the back leaves remaining stationary in this, as well as in the cross shed. But in this shed it is necessary to connect the marches with the plain treadle, to keep the half leaves tight when the weights are raised, the fore mounting in the plain shed being exactly in the same situation as in the open shed.

From the descriptions now given of gauze weaving, we hope that any weaver of even common perception, who will study them with care and attention, will find little difficulty in mounting a gauze loom *for himself*.

When the principle of gauze weaving is thoroughly understood, its application to the weaving of fancy nets may be easily acquired. Many varieties of net work are used, but a few which form the groundwork of all the rest, will be sufficient to elucidate the general principle; and, to use the words of a certain learned doctor of book-making notoriety, "the limits to which it is necessary to restrict this Work, will not admit of more particular details."*

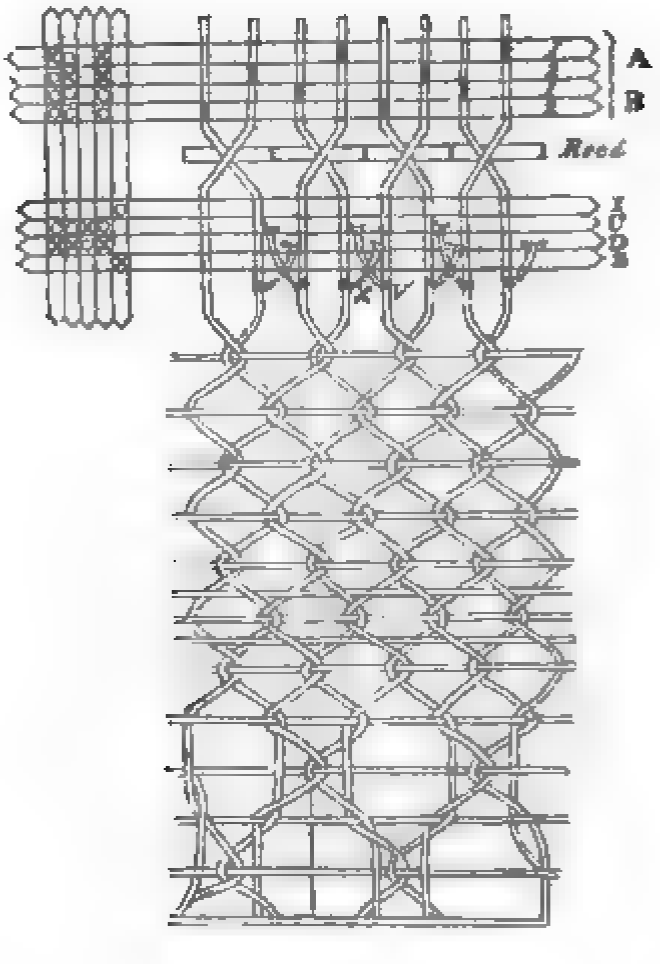
WHIP NET.

This net takes its name from the warp being wholly of whip, without any other ground. The term *whip* is used by weavers to denote a species of warp rolled upon a separate beam to form fancy patterns. In this net the whole warp is of this description; and,

* The principal reason why we are thus restricted is, that we have *already* extracted from the works of others all the valuable or "*luminous*" information which they contained about the manufacture of "*textile fabrics*."

therefore, only one beam or roll is required. The mounting of the whip net, like that of the common gauze, as already described, (see Figs. 49 and 50,) consists of two back leaves, two standards, and two *bead lams* or half leaves. The two back leaves are placed behind the reed in the usual way, and the bread lams with their standards are placed in front of the lay, between the race board and the reed, as formerly mentioned. But as glass beads are frequently used instead of eyes in the back leaves also, and these mountings are generally constructed to weave dropped as well as plain nets, the back headles are usually divided into four leaves; by which the friction is avoided that would be occasioned by the beads being too much crowded together.

Fig. 55.

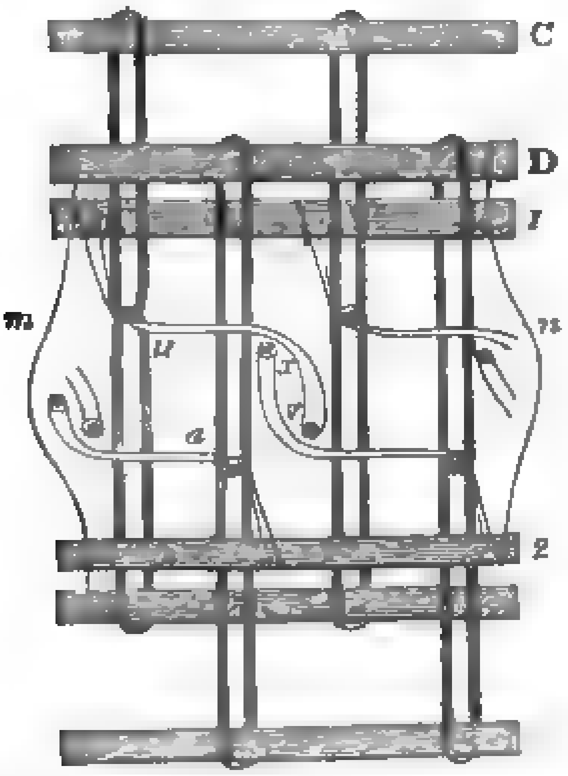


is a plan of the whip net mounting, with a specimen of the cloth annexed, both when it is woven plain, and when it is dropped. A and B are the two back leaves, each of which being divided into the other two parts marked 1 and 2; C and D are the standards; and 1 and 2, the half leaves or bead lams, corresponding with the doups and standards of the full gauze mounting, (see Figs. 49 and 50.) The reed, which shows also the position of the lay, is here seen between the back and front mountings. Let the dots on the leaves C and D represent sections of the twine of which the headles

are made, and they will point out the position of the standards. The upper bead lams with their beads, through which the whip threads are drawn, will then appear as passing through the headles or standards on the leaf C, the beads being in front at *v*; and the under bead lams will be seen as if rising through their standards on the leaf D, crossing below the others towards the front at *x*. The marks on the treadles will point out the raising and sinking cords, as in the plain gauze.

But the manner in which the bead lams cross in front of the standards will appear to more advantage in Fig. 56.

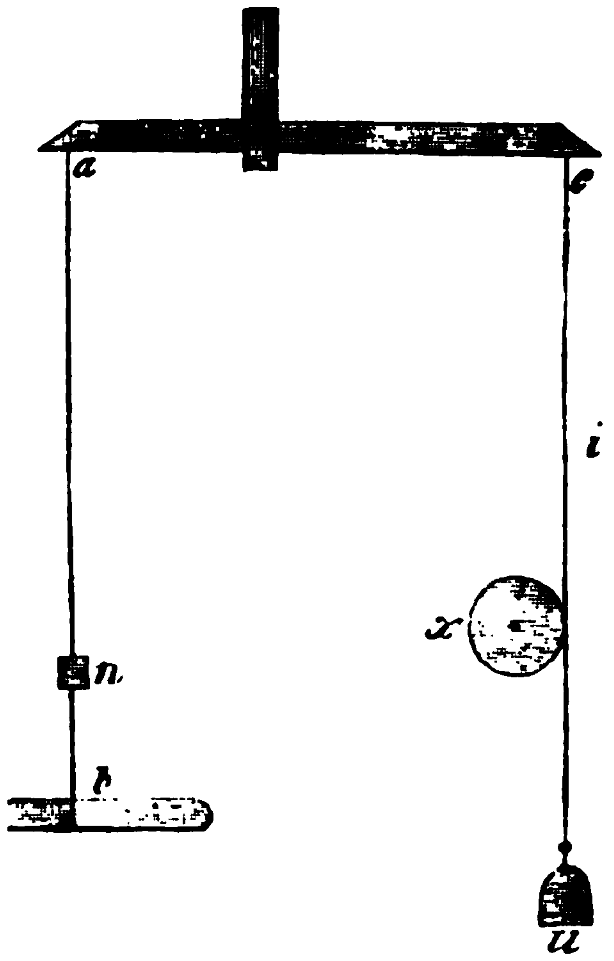
Fig 56.



Here the upper bead lam shaft is marked 1, and its standard C; the under lam 2, and its standard D, as in Fig. 55. When the open shed is formed, the bead lams assume the position represented in Fig. 56 at *x*, and *v*, that is, the bead lam *x*, on the shaft 2, crosses in front of a standard on the shaft C, and rises on the left of the bead lam *v*, while the bead lam *v*, on the shaft 1, crosses in front of a standard on the shaft D, and sinks on the right of *x*: the threads passing through these two beads, being on the same interval of the reed, this forms the open shed; which is pointed out by the pick 2 in Fig. 55. Again, in forming the cross shed, the bead *v*, is drawn close to its standard at *u*, and the bead *x*, is drawn back to its standard at *a*, (see Fig. 56,) while the standard D is raised, and C sunk, as in the cross shed of the common gauze, (this shed is marked by the pick 1 in Fig. 55,) and thus the crossings of the whip are effected.

It was formerly observed that the back and front mountings of the gauze are placed at about three and a half or four inches apart, that the warp may have sufficient room to twist between them in opening the cross shed. In nets, however, the corresponding crossing of the whip takes place in front of the standards, where it is forced nearly into a vertical position. It is therefore necessary that the whip should be slackened more in the cross shed than any other kind of warp, so as to yield freely to the pressure of the cross treadles; otherwise it would be *almost* impossible to obtain a shed. The method usually employed for this purpose, both for this and the other nets, is as follows: *a o*, Fig. 57,

Fig. 57.



is a couper suspended from the ceiling of the weaving room, or from the top of the loom, from the end *a*, of which a cord descends to the end of a long march *n*, which is again connected to the cross treadle *t*. To the other end *o*, of the lever or couper is tied the cord *i*, which after taking two turns round the whip roll *x*, suspends the pace weight *u*. Sometimes a thong or strap of leather is used for that part which goes round the roll, and a little chalk rubbed upon it to prevent it from slipping. Now, it is plain that when the cross 1, is pressed down, it sinks the long march *n*, and consequently the end *a*, of the couper, by which the other end *o*, will be raised, and turn the roll round on its axis by the cord *i*. By this means the whip is slackened, and a greater or smaller range is given to it, to suit any given pattern, merely by shifting the fulcrum or centre of motion farther from, or nearer to the end *o*, of the couper.

There is another circumstance which requires particular attention in the manufacture of nets, that does not occur in gauze. In the gauze mounting the two threads of each dent of the reed rise and sink between their respective standards and in the cross shed the doups or half leaves are drawn tight by the weights, so as to pass each other without any friction ; *especially if the web be properly mounted.* In the whip net, however, see Fig. 56, the bead lams project beyond their opposite standards ; and, therefore, were the weights allowed to act upon them with their whole force, they would be drawn so tight or close to their standards, as to prevent the beads from *tumbling*, as it is termed ; or the cross shed from opening freely. On the other hand, were the bead lams too slack, the friction occasioned by the tumbling of the beads would soon prove destructive to the standards, besides being liable to get frequently entangled among the warp. To prevent both of these inconveniences, each bead lam shaft is connected at each end to the opposite shaft of its respective standard, by a piece of twine called a bridle, as represented at, *m*, *n*, in Fig. 56. By means of these bridles the weaver can temper the front mounting as he pleases, as they are made with snitches, the same as those on the treadle cords of looms for tweeling. Sometimes the under bead lam shaft is bridled to the end of the couper of the front standard, by which method the bridles are kept clear of the shuttle. In general the bead lams project through their standards, when the mounting is stationary, about a quarter of an inch ; but every weaver tempers his bridles to such a degree of tension as may best suit the state of his mounting.

It may be further observed of nets in general, that the weaving motions should be *very slow, uniform, and steady.* The sheds are opened by a gradual pressure of the foot upon the treadles, without any sudden jerks, which would cut the whip, and in a short time ruin the mounting. At the same time, the lay is worked with a steady motion, while the shed is opening. The shuttle is driven through the sheds with equal caution, lest it should dip or get entangled among the bead lams or standards. This, however, is in a great measure prevented by pins of brass wire driven into the lay, immediately behind the race board, along which the shuttle runs, instead of the reed as in other kinds of weaving. After the pick has been thrown into the shed, the treadle is relieved in the same gentle way, by which the weights have sufficient time to act upon the bead lams, and keep them in a uniform degree of tension, while the lay is brought forward with the same steady motion to the face of the cloth.

It is also of the greatest importance that all the cordings be properly tempered; which, with due attention, will be easily effected by means of the snitch knot,* which must be well known to every practical weaver.

As the crossing of the whip in net weaving necessarily produces considerable friction, a greater power is requisite to be exerted on the cross treadle than in any other species of light fabrics: for this reason, the treadles are placed below the warp roll, and the weaver works on the ends towards him, by which he gains the whole of the lever power.

SPIDER AND MAIL NETS.

These two nets are woven in the same mounting, and have the same relation to each other as the gauze and lino.

The mounting is merely that of the common gauze, which is here called the ground, combined with that of the whip net, with which the ground is interwoven.

The gauze part of the mounting, and the back leaves of the net, are placed behind the reed; and the two bead lams and their standards are before it, as in the preceding mounting, (Fig. 55.) Either of the methods for reducing the number of leaves, formerly explained, may be adopted for the ground; although the full mounting is generally preferred: for, with the full mounting only two warp rolls are necessary, one for the ground and the other for the whip, while either of the former methods require two for the ground, that one-half of the warp may yield a little more than the other while the cross shed is forming.

The Spider net is woven with two treadles which produce the texture of plain gauze, interwoven with the whip: the mail net requires only the addition of a plain treadle on which every fourth pick of weft is thrown, as in Fig. 58.

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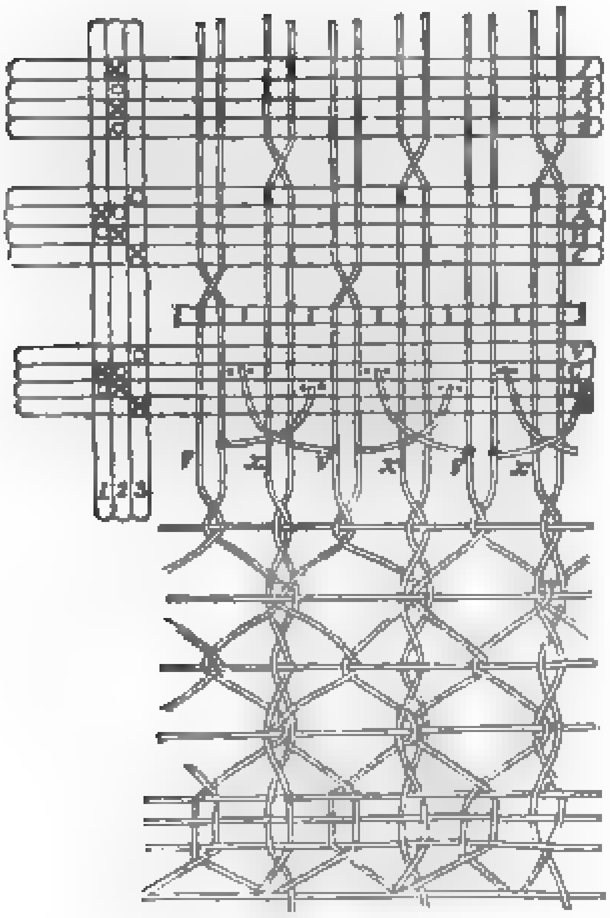
* This is merely a modification of the *slip knot*, known to Irishmen under the name of *O'Doherty's*, or the *hangman's noose*.

SPIDER NET.

Fig. 58.



is a plan of this mounting, with specimens of the varieties it produces, in which the different crossings of the ground and whip may be easily traced. The back leaves of the gauze are marked 1 and 2, the standards A and B, and the doups, *a* and *c*. The back leaves of the net are marked 3 and 4, and these are all behind the reed as formerly noticed. In the front, between the race board and the reed, are placed the whip standards C and D, with their respective bead lams, *v* and *x*. The position of the whip standards, with respect to the threads of warp, is pointed out by dots on the shafts C and D, one on each side of its respective bead lam; these lams appear in the fig. as if a little slackened by the open shed, and crossing each other in front of the standards, exhibit the whip threads passing through the beads at, *v* and *x*, (see Fig. 58.) The crossing of the bead lams, when the open shed is fully formed, will appear to more advantage in Fig. 56, the threads of gauze warp being in the position of the letters, *v* and *x*.

By comparing this plan with those of the gauze (Figs. 49 and 50) and whip net (Fig. 55) considered separately, the process of taking the warp through the beadles and tying up the treadles will be obvious, and can require no further explanation; for each of the

mountings are tied to the treadles in the same order as if they had been mounted separately.

It may be necessary to observe, however, that when the full gauze mounting is employed, as in the present example, or when the back doup and standard are omitted, each treadle will produce similar sheds in both mountings; that is to say, either both open or both cross, but when the gauze part is mounted with the bead lam and standard, it is necessary to cord the treadles so as to produce the open shed of the gauze along with the cross shed of the whip; otherwise the whip would not run in between the threads of gauze warp to form the net distinctly as represented in the specimen. (See Fig. 58.)

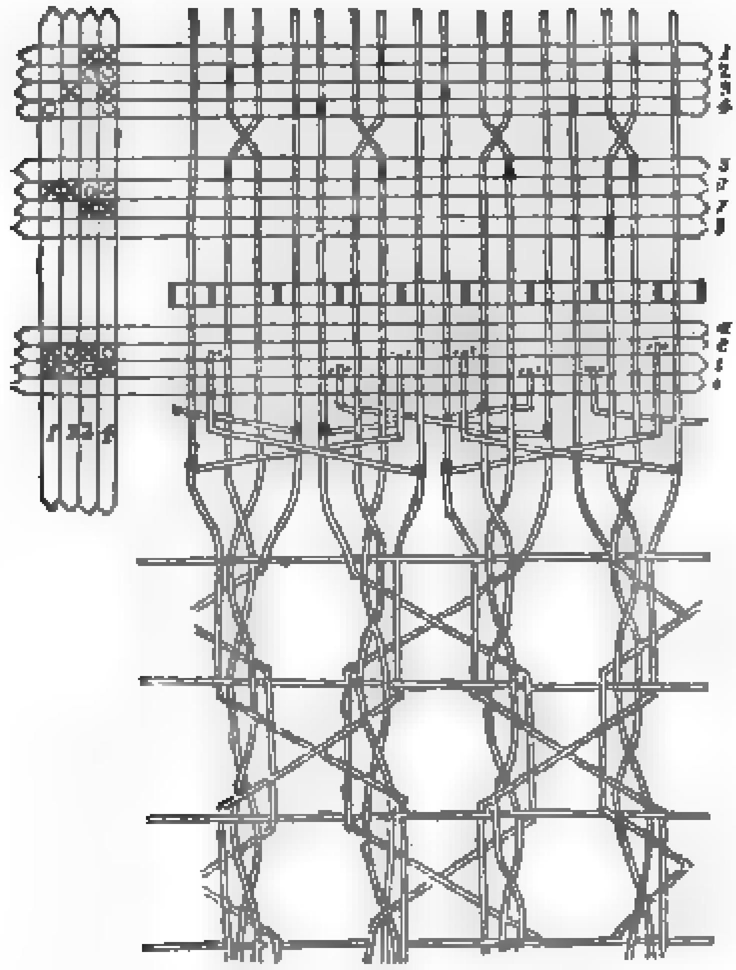
The apparatus for slackening the whip in the cross shed, as well as the bridles for preventing the bead lams from being drawn too close to their standards, are also necessary in this mounting, and are applied in the very same manner as in the whip net.

PATENT NET, OR NIGHT THOUGHT.

This net, like the preceding, consists of a gauze ground interwoven with whip. Two sets of mounting are therefore requisite, one for the ground and the other for the whip or net part; but, as this net involves greater variety than any of those already explained, it requires four treadles to work one set of the pattern. Either the full mounting or one of the contracted methods may be employed for the gauze part, and the whip requires two back leaves, and two bead lams and their standards. When the full gauze mounting is employed three warp rolls are requisite, one for the ground and two for the whip. These last are necessary, as one half of the whip is occasionally crossed while the other half is straight and parallel, and consequently each half must be slackened independently of the other. When the gauze part is woven either with the bead lam shaft, or by omitting the upper doup and standard, two rolls are also necessary for the ground, as formerly described. Some add another roll for the selvages, which, being woven plain without any twist, do not work up equally with the other warp. This, however, is commonly avoided by beaming the selvages on the same roll with the ground, and suspending a small weight to each below the roll to keep them moderately tight, and the slack part is taken in at the face of the cloth, when necessary, at the end of the piece.

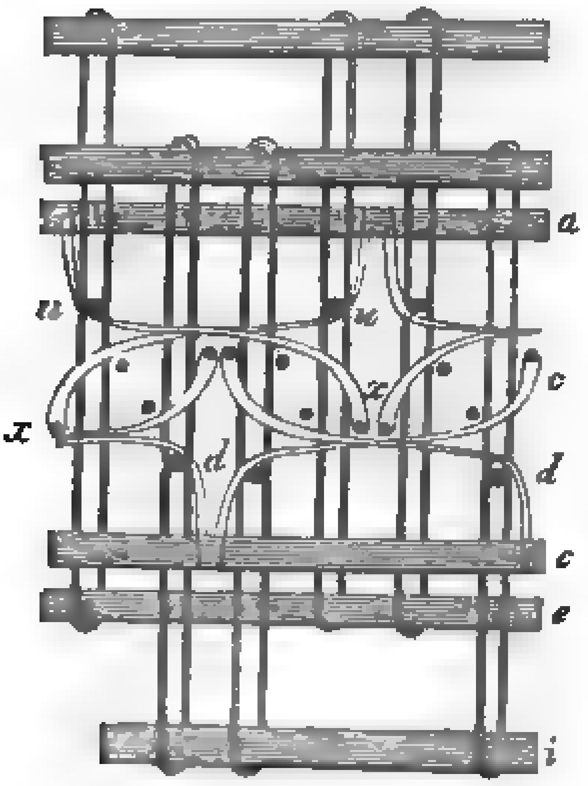
PATENT NET, OR NIGHT THOUGHT.

Fig. 59



is a plan of the night thought mounting, with a specimen of the cloth, as in the other examples. The shafts marked 1 and 2 are the back leaves for the gauze part, the back leaves for the whip being marked 3 and 4. 5, 6, 7 and 8 are the doups and standards of the ground mounting, which in this example is a full mounting; the bead lams and their standard which are before the threads are marked, *a*, *e*, *i*, *o*, and are placed exactly in the same position as in the other mountings for net weaving.

Fig. 60.



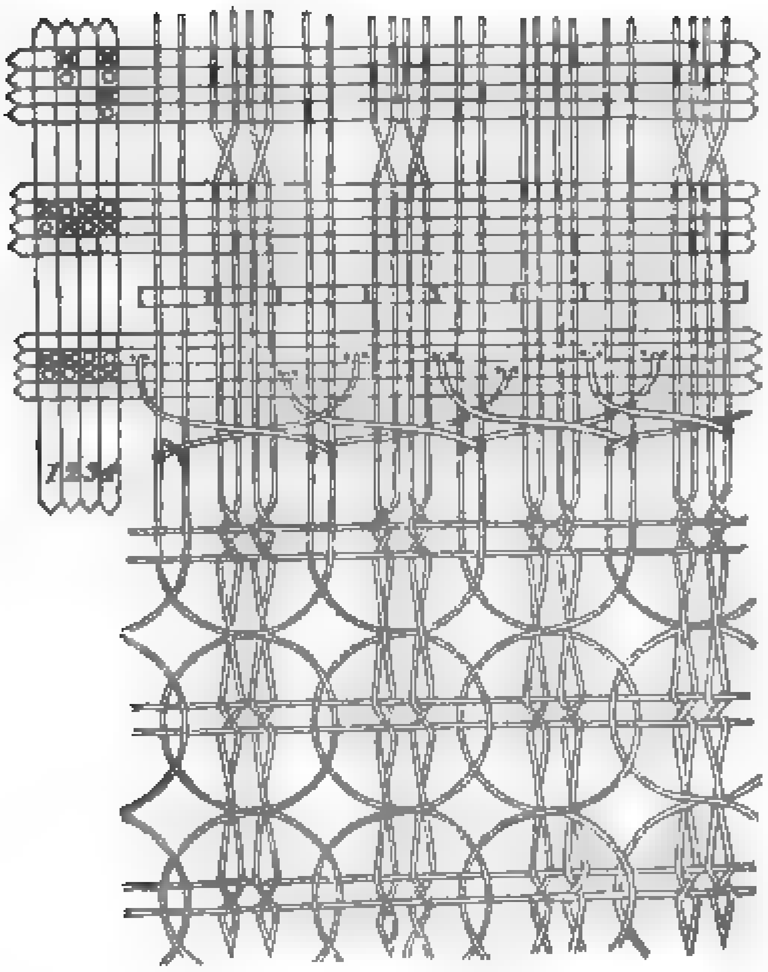
is a front elevation of the bead lams and their standards, representing their position when the open sheds are formed; *a*, is the shaft of the upper bead lams, and *o*, that of the under ones; *e*, and *i*, are the back and fore standards respectively. In the shed here exhibited, which is opened by the treadle marked 4, (see Fig. 59) both the upper and under lams are slack, and after crossing two dents of gauze and one of whip, the former are sunk and the latter raised by the whip which is now acted upon entirely by the back leaves. That is, the upper lams cross from their standards at *u*, to the interval *x*, where they are sunk; and the under ones from *d*, to *c*, where they are raised (see Fig. 60.) The treadle 2 (see Fig. 59) draws both the upper and under lams tight to their standards, by which the former are sunk and the latter raised; at the same time the ground forms the open shed. In the shed formed by treadle 1, the upper lams are tight and sunk by their standards, while the under ones are slack and raised by the whip, the ground forming the cross shed. All this will plainly appear by an attentive perusal of the two Figs. 59 and 60

PRINCESS ROYAL NET.

This net is woven in a mounting the very same as that of Night Thought, but with a small difference in the order of taking the whip through the headles and tying up the treadles.

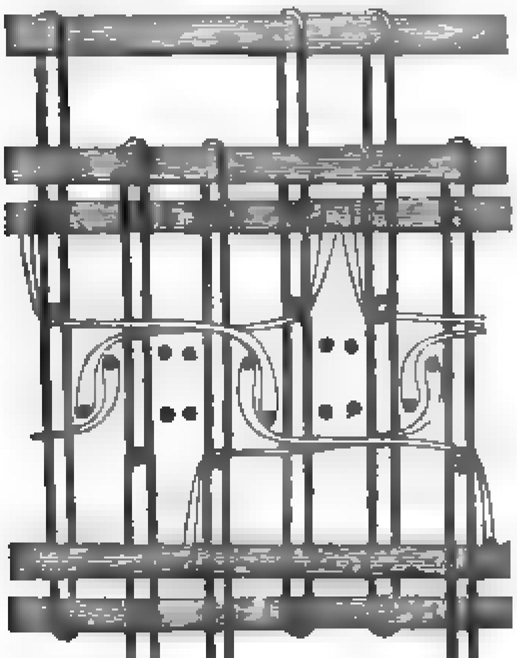
But as these are distinctly marked on the plan Fig. 61.

Fig. 61.



they can require no further explanation. Fig. 62

Fig. 62.



shows the crossing of the bead lams in the open shed in the same manner as in the preceding net.

DROPPED NETS.

The whip and mail nets are frequently ornamented with a variety of figures, which are formed on the cloth merely by preventing the crossings of certain portions of the whip, for one or more picks of weft, which leaves open spaces in the ground larger than the common meshes of the net; this may be effected either by preventing part of the upper bead lam whip from sinking, or of the under bead lam whip from rising, in the open shed, by means of additional back leaves applied for that purpose.

These examples, it is presumed, will be sufficient to explain the nature and process of net weaving, and to show that by changing the order of the draught, cording and treading, considerable variety may be produced in these fabrics.

SECTION FIFTH.

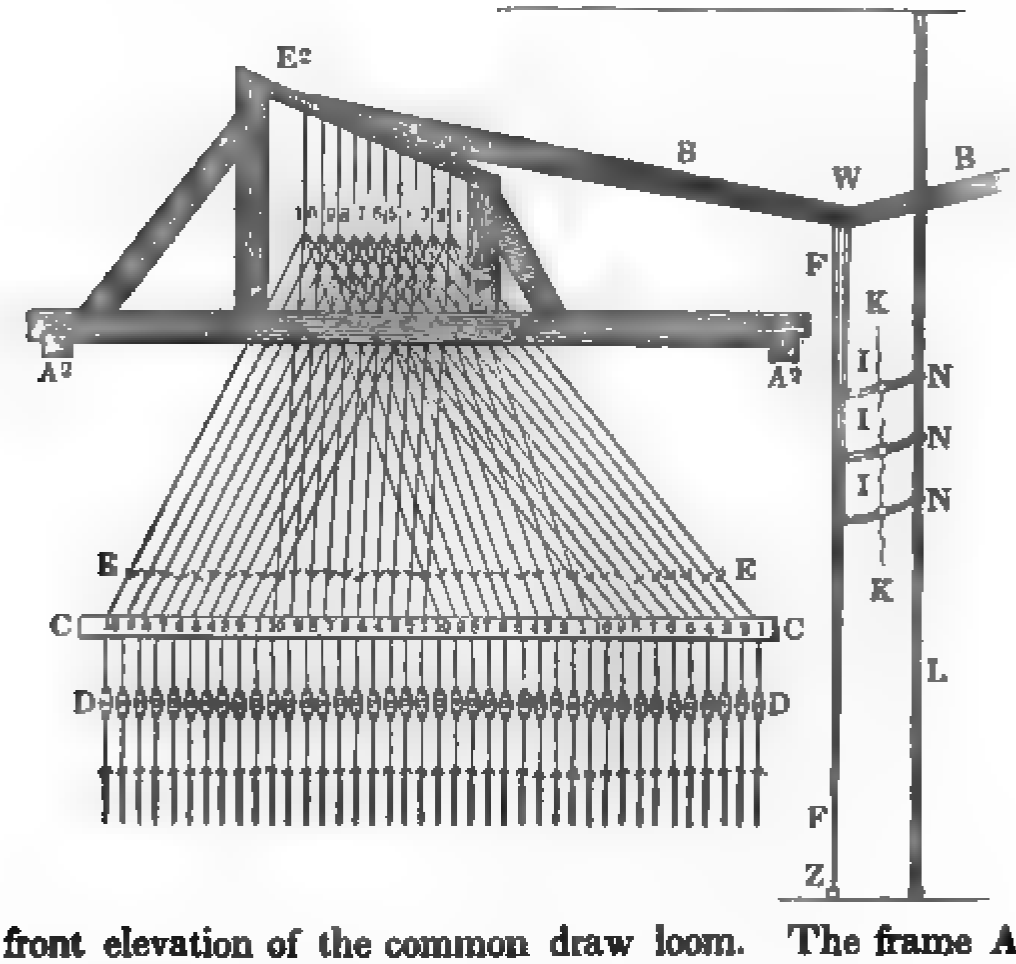
FIGURED WEAVING.

We've heard of labyrinths and gordian knots,
And other things which try your men of skill;
But here we for a time shall turn our thoughts
To something even more complicated still.

Having described in the preceding sections the elementary principles of weaving, and developed some of their most useful combinations, with the necessary illustrations to make them perfectly understood, it now devolves upon us to show how these principles may be extended beyond the scope of leaves of headles, by aid of the draw loom.

DESCRIPTION OF THE DRAW LOOM.

Fig. 63.

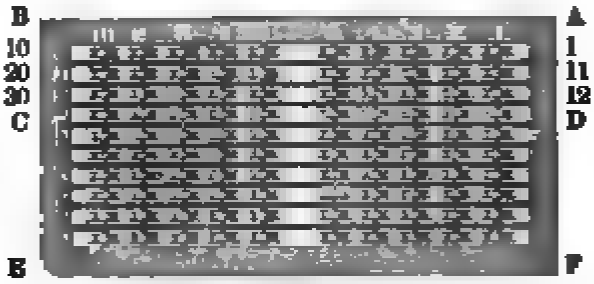


is a front elevation of the common draw loom. The frame AA is called the carriage, from its use in supporting the harness; and rests on the capes of the loom, which are seen in section at $A^2 A^2$. On the top of this frame is fixed the pulley box E^2 which contains the

pulleys over which the tail cords run when any part of the harness is raised to form a shed, or sheds.

This box, a horizontal view of which is given in Fig. 64,

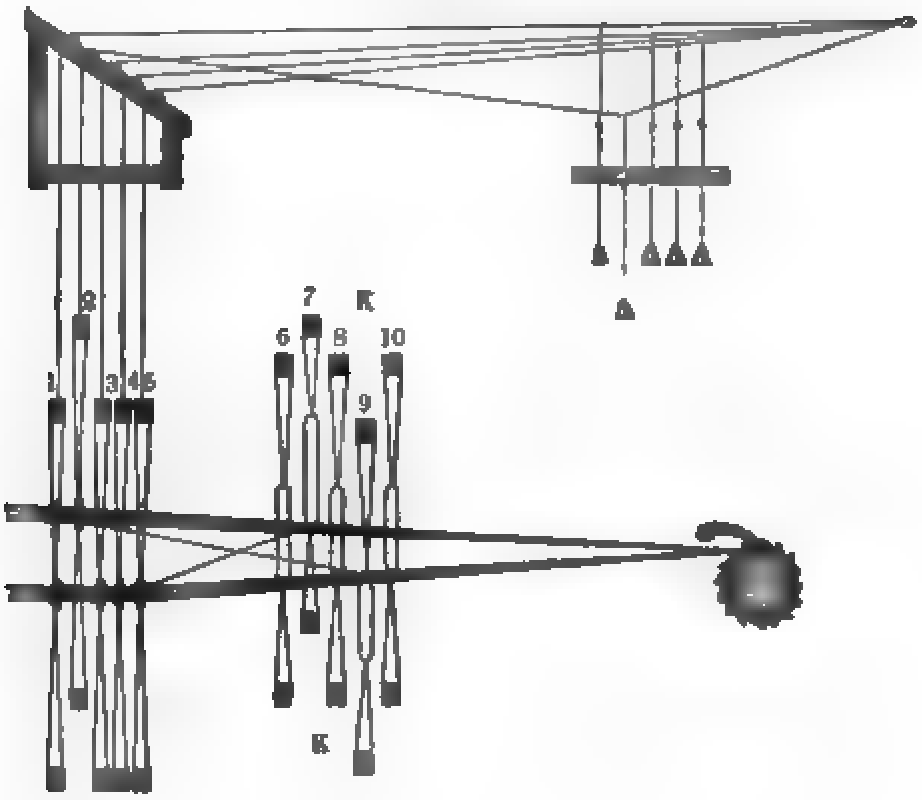
Fig. 64.



is placed in a slanting position sufficient to allow the tail cords BB to sink in opening the sheds, without obstruction from the frame or pulleys below.

The harness is composed of the following parts; namely, the neck twines, which extend from the neck of the harness, as pointed out by the figures of reference 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, to the knots at EE; the sleepers,* which connect the neck twines with the mails at DD; the mails, which are the substitutes for the eyes of headles, through which the warp threads are drawn, and of which a more distinct view will be found in Fig. 65;

Fig. 65.

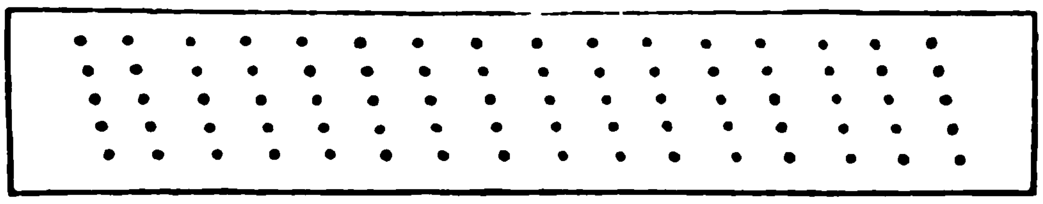


* The name usually given to that part of the cords or mountings which passes through the board CC, commencing at the knots EE, and ending at the mails DD.

the twines, that connect the mails and leads or weights at XX, called hangers, to sink the mails after they have been raised to form the shed or sheds.

CC is the hole board,* through which the sleepers pass; and this regulates the distance of the mails and the fineness of the harness. The face of this board is represented in Fig. 66,

Fig. 66.



in which it will be observed that the holes for the harness twines run in oblique lines, that the mails may have sufficient room to stand directly opposite to their respective intervals of the reed, without being too much crowded together. The reed and harness board, therefore, must be of the same set or fineness; or should a harness board of a finer set than the reed be at any time employed, the supernumerary holes must be left empty at regular intervals and in complete rows, as in the method followed by weavers in setting their headles. It may be observed, however, that although the sets of reeds in Scotland be calculated on 37 inches, yet the sets of the harness board are comprised in 36, so that in 37 inches of the harness board there will be the number of dents contained in one inch of any given set more than in the same breadth of the reed. As each part or division into which the harness is tied begins always with a complete row of the harness board, this addition is made as an allowance for any holes that may be left empty at the ends of such parts as are not multiples of five. Thus were the harness to be tied into such parts as 100, 105, 110, 115, &c., mails, every part would exactly fill a certain number of rows in the harness board when there were five in each row: but in a tie of 102, for instance,

* Called hole board from the fact of its being pierced with a great number of holes; a clearer view of which will be had in Fig. 66. Scotch weavers often call it by the name of "holy brod;" but the words *holy* and *righteous* being almost synonymous, we think the latter of these terms quite as applicable as the former; however, we shall excuse these *broad* Scotchmen, as they are, no doubt, a very *holy* people. Among Yorkshiremen, the appellation of "cumber boord" is used for this part of the loom, from the circumstance of its being much *encumbered* with strings, &c.: but, for our part, we would prefer the Yankee name of "harness board."

there would be three holes left empty at the end of each part; which, consequently, would make the harness considerably broader than the reed, were it not for the above allowance. It may be further remarked, that, although in the present example there are only five holes in each oblique row in the board, which is the number appropriated to four thread harnesses, yet in dent and full harnesses, where a greater number of mails must necessarily occupy the same space, the number of holes in each row is extended to ten, and in French shawl looms even sometimes to thirty-two.* From these observations it will evidently appear, that two mails will stand opposite to one interval of the reed in a full harness; one in a split or dent harness; and in a four thread harness, one mail will occupy the space of two dents or splits of the reed.

From the tail at W descends the simple cords F F, or as they are termed collectively the *simple*, down to the floor at Z, where they are fastened. It is on this part of the draw loom that the pattern is read on from the design paper. The twines at I I I are termed the *lashes*, and are necessary for separating the simples of any shed which is to be opened from those that remain stationary; N N N are the heads to which the lashes are attached, and are made to run or slide with a noose on the gut cord L, at pleasure. The gut cord commonly extends from the roof of the shop to the floor, (as shown in Fig. 63,) parallel to the simple. K K are the bridles, which being connected with the lashes at equal distances, draw them down in succession as they are wanted by the draw boy.

The number of mails necessary to produce one set of a pattern, make what is denominated a *part*, or the tie of the harness; and as every mail in one part must rise independently of the others, each must have its respective cord both in the tail and simple; so that the greater the range of the pattern, the greater will be the number of simple cords. Hence it is evident, that were a harness to be tied in one part only, there would be a tail and simple cord for each mail in the width of the web. But as patterns of this extent are not very common, it is usual to divide the harness into such a number of parts as may be most suitable to that species of goods on which it is to be employed, and these parts are repeated to make up the full width.

By this means the number of tail and simple cords, together with

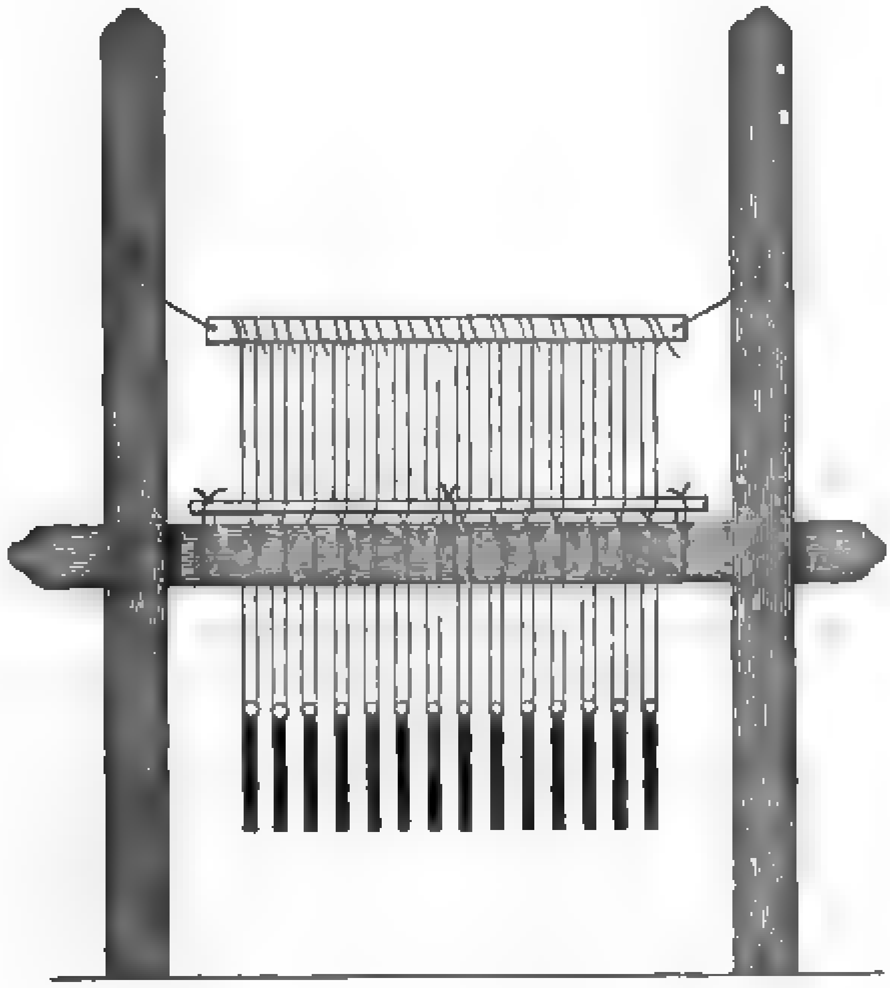
* Our friend, Monsieur Dioudonnat, of No. 12 Rue St. Maur, Paris, (France) generally pierces his harness boards with thirty-two holes in the row (in breadth.

the pulleys, will be diminished in proportion as the number of parts in a given harness are increased. It is also obvious, that as each simple cord is connected, by means of its tail cord, to a corresponding mail in each part, the pattern which is produced will be merely the same group of figures, repeated as often as there are parts in the harness or mounting.

MOUNTING THE LOOM.

When a harness is to be *constructed*, as it is termed, a frame, such as is represented in Fig. 67.

Fig. 67.

A²  A²

must be procured; and the two upright sides, AA are fastened to the inside of the loom, one on each side, and in the very same position between the cloth and the warp rolls, which the harness is afterwards to occupy. The cross bar of wood or slab stock A² A², slides up and down in grooves cut in these side pieces, and may be fixed with small bolts at any given height, to suit the position of the mails after the harness is tied. In the upper edge of the slab stock, which is somewhat rounded, is a groove into which the under ends of the mails are inserted during the process of mounting the harness.

This frame being thus adjusted, the operator proceeds to hang the leads, or connect them to their respective mails. This is effected by taking one end of the harness twine, cut of the proper length, through the under hole of the mail, and again through the upper end of the lead; after which both ends of the twine are stretched down below the slabstock, one on each side, where they are knotted, and the knot slipped down to the top of the lead, so as to be clear of the warp when the sheds are opened; the distance between the mail and the lead being about nine inches. A more durable method of hanging the leads, however, is to take both ends of the twine through the hole of the lead, and then turning them backward, one on each side, to knot them together. These twines or hangers are made of flaxen yarn, from three to nine ends laid together, and must be well twisted.

The harness leads are made by cutting a piece of sheet lead into long square slips, and afterwards drawing them through circular holes of different diameters in a steel plate, till reduced to the requisite size; after the manner of drawing other metallic wires. They are afterwards cut off to the proper lengths; and the weight suitable for any harness is estimated by the number of these pieces in a pound. Thus, for the borders of shawls in the cotton manufacture the leads are from fourteen to sixteen inches long, and those for the bosom or body from eight to ten. The weight of leads for a four thread harness will be about fourteen in the pound for the borders, if intended for shawls; and from forty-five to fifty-five for the bosoms, being, however, governed according to the number of parts into which the harness is tied; for the greater the number of parts, the more leads will be attached to each simple cord; and therefore, they must be proportionably lighter, and the contrary. The leads for the borders of a two thread shawl are the same as those of the four thread, provided the borders are not gathered; but for gathered borders, which have double the number of threads attached to each simple cord, they are from twenty to twenty-five in the pound, and of the same length as the fourteen to the pound. The bosom or body leads are from fifty to sixty in the pound, according to the number of parts in a given breadth of the harness and the number of lashes requisite for the pattern; for, it is evident that the more lashes there are on the simple, the greater will be the friction on the simple cords in passing through them; and consequently the leads must be heavier to sink the mails after being raised. Full harnesses, in general, require leads from eighty to a hundred in the pound for the bodies of shawls, but if the parts into which they are

tied be numerous, the leads are sometimes used as light as a hundred and ten.

When the leads are all hung, and the under ends of the mails inserted in the grooves of the slabstock, a piece of strong wire, (flattened by passing it between a reed maker's rollers,) is run through their eyes, by means of which they are all kept at the same uniform height. The wire is then tied firmly to the slabstock with pieces of strong twine, at such distances as are sufficient to prevent the wire from bending, or allowing any portion of the mails to rise higher than the others while tying the neck; all of which process will be apparent by referring to Fig. 67.

When the sleepers are taken through the upper holes of their respective mails they are divided into the parts or portions in which the harness is to be tied. The holes in the harness board are then counted off for each part or pattern, commencing with the hole nearest the right hand selvage; which, *if a right hand harness*, will be in the front, as at Fig. 66; but in the backmost row on the board, *if a left hand harness*. Changing the position of this hole from the front to the back row is effected merely by turning up the other face of the harness board. Then, if the part be composed of any number of fives, as 30, 35, 50, &c. six, seven, ten, &c. of the oblique rows are set off for each part respectively; but if the part is not divisible by five, as for example the number 64; then, there must be thirteen oblique rows appropriated to each part, which will leave one hole empty at the end of each, as was formerly observed. The sleepers are now taken up through the harness board in regular succession.

The board is next fixed very firmly in the centre of the loom, exactly in the same situation in which it is afterwards to remain, and at the height of about 8¼ inches above the mails. The sleepers, which are made of the same twine as the hangers, are in length, from the mails to the knots above the harness board, about 15¼ inches. The position of the harness in the loom will depend in a great measure on the nature of the work in which it is to be employed. Thus, for example, a pressure harness must stand further than a full harness from the breast-beam; which is that wooden bar over which the cloth passes to the receiving roll. The common distance of a pressure harness from the breast-beam is about twenty-two inches; and a full harness eighteen inches; and of a seeding harness, which in general is placed before the ground leaves about twelve inches. The height of the mails in a full harness is about three-fourths of an inch below the level of the breast-beam; in the

split and four thread harness the mails should stand about one inch and a quarter below this level, and to these respective heights the harness board must be accurately adjusted.

The mails being now divided into parts, the sleepers of the first part are laid over the edge of the harness board on one side, and those of the second on the other, and so on alternately, that each part may be kept distinct from the others; then the twine or sleeper attached to each mail, being now double, is knotted to its respective neck twine; which must be cut of a length sufficient to reach from these knots to the ends of the tail cords at the neck. This process is called *beeting the harness.* These neck twines are made of three ends of flax yarn, well twisted, and weigh from two and a half to five and a half ounces per hank of four cuts: the coarse twine being employed for those harnesses which are divided into the fewest parts. These neck twines, however, will vary in length according to the width of the harness. For example, for a harness fifty-four inches wide, the neck twines may be five feet six inches long.

In the process of beeting the harness the snitch knot used on the treadle cords in tweeling, &c. is mostly employed, to enable the weaver to adjust any of the twines that may have been slacker or tighter tied than the others; and this is effected when the neck twines are single, which is commonly the case for light fabrics, by casting a loop knot on one end and forming it into a snitch, through which the two ends of the sleeper are taken and knotted in the usual way, to prevent them from slipping. In some harnesses, however, which are intended for stouter fabrics, the neck twines are taken double through the hole board; in which case the two ends of the sleeper are tied together, and formed into a snitch, into which the two ends of the neck twine are inserted, and afterwards knotted.

Before the operator can proceed further, the tail must be warped; which is effected by winding the twine round two nails or pins, fixed in the wall of a house at a distance from each other equal to the whole length of the tail, and this is commonly about eighteen feet; though some tails are now made as short as fourteen. This part of the draw loom is made of what is termed by the spinners of this article, *unlaid* twine, a quality which prevents it from untwisting after it is tied to the neck twines of the harness.

When the requisite number of tail cords, *which must always be equal to the number of mails that are to rise independently of each other*, are thus laid together, a lease, as in warping, (see Fig. 3, Section 1st.) is formed at one end, and the loops cut at the other; at the lease end the loops are separated into small parcels, con-

monly five in each, and formed into snitches, by which they are fastened at equal distances round the tail stick so that they may stand nearly equal to the breadth of the tail. This piece of wood or tail stick is fastened to the ceiling of the shop where the tail terminates. The other ends of the tail cords are taken through the pulley box, with the assistance of a small hook, in the following order: supposing the tail cords to be numbered 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, from the bottom of the back row at A to the top at B, (see Fig. 64,) then the first ten cords will pass over the pulleys from 1 to 10 respectively; the second ten cords over the pulleys 11 to 20; the third ten over 21 to 30: and so on, always commencing each row of pulleys at the lower part of the box A.[2] All these arrangements being made, and a wooden frame called mounters or justers, such as that employed in mounting leaves with coupers, is fixed to the cape of the loom and over the tail at W, to keep the cords equally tight and at the proper angle, the harness is then ready for tying.

In the plan of a harness Fig. 63, it will be observed, that there are ten mails numbered on the edge of the harness board, which is repeated four times, indicating that the harness is tied in four parts of ten mails each, which supposes only one row of holes in the harness board. But as there are five such holes in the board Fig. 66, though, to save room in the representation, there are only sixteen oblique rows, the harness may be calculated upon fifty mails for each part, which, though still on a limited scale, will be sufficient to explain the principles upon which the draw loom is mounted. Either one or more assistants, as the extent of the harness may require, are stationed at the side of the harness board, to take up the twines in the order in which they occur, and hand them to the person who ties the neck. In this example the right hand twine of each part is selected and given to the operator, who ties all these four twines to the tail cord numbered 1, or that which passes over the first pulley in the box, as already mentioned. By the time this is tied the second twine of each part in succession is ready to be handed up, which the operator ties to the second tail cord marked 2, and so on with the others till the fifty be tied; which, in this example, occupy one half of the box. (See Fig. 64.) It must still be remembered, however, that when the first ten tail cords are tied which complete the first row of pulleys, the operator must again commence at the bottom of the box, as at first.

The knot here employed is formed by taking the four neck twines in one hand and the end of the tail cord in the other; then,

laying the former over the latter, he takes the turn of a knot on the upper part of the tail cord, or that immediately above the figures 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, in the drawing Fig. 63, with the part which he holds in his hand; then another knot round the same with the ends of the neck twines.

The principal care to be taken in tying the neck is, that the twines from the different parts be equally tight, and that the knots be all in the same horizontal line, sufficiently far below the pulleys to prevent their coming in contact when any part of the harness is raised to form the shed or sheds. To assist the operator in this, he places a rule or scale along the inside of the carriage, in the position U O, in a line with one edge of which he ties his knots; and this scale he shifts forward as each row of cords is tied. On the same scale are marked the distances at which the ends of the tail cords should descend vertically, so that the harness may hang perfectly plumb in the loom after it is completed. Before the tying commences, however, a lead is suspended by a piece of twine from the centre of the pulley box E, to which the centre of the harness is accurately adjusted; or, which is more accurate, two leads are suspended, one over the fifth, and the other over the sixth pulley, at the centre of the box, counting from the bottom, and half the distance between these will be the position of the centre of the harness board.

The next process is to warp and apply the simple, which is prepared in every respect in the same manner as the tail, though only about six feet ten inches or seven feet long, less or more, according to the height of the shop; it has also a lease, formed at its lower end, for the convenience of selecting the cords when required: this lease, however, is merely temporary, being retained no longer than while the simple is tying to the tail; from which it can at any time be recovered when it again becomes necessary. The operator now ties each cord of the simple to its corresponding tail cord at W, (see Fig. 63) each of the cords being readily found in succession from its respective place in the lease. In order, however, that the knots of the simple may not be too much crowded on the tail, the simple cords are usually tied in two, or three, or more rows, according to the number of cords which it contains, as represented at W in the Fig.

The simple is made of what is termed *laid* twine, which distinguishes it from that of the tail, and weighs from twenty to twenty-seven hanks in the pound, but in every other respect it is

the same as the tail twine formerly described, consequently one hank will produce twenty simple cords seven feet long.

The lashes I I I are formed by taking the lash twine around certain portions of the simple cords as explained under the head of reading or lashing the pattern, Fig. 70, and which, as formerly noticed, serve to select the cords of each particular shed. Each turn of the lash twine round any part of the simple is called a tack, and the whole number of tacks requisite for one shed constitute a lash.

Lash twine is now commonly made of cotton yarn, about No. 48, water twisted, and from six to eighteen plies laid together, and moderately twisted; for too much twist causes the twine to curl on the simple and obstruct the draw boy's progress. The twine composed of the greater number of ends is chiefly employed for stout fabrics, or when only few lashes are requisite for the pattern; but the more lashes there are on the simple the finer is the kind of twine which is applied, to occupy less space, as well as to afford the draw boy sufficient room to work.

The length of the lashes, exclusive of the heads, is commonly from eight to twelve inches, according to the breadth of the simple; for were short lashes, for example, to be employed on a broad simple, the simple cords on each side would be drawn into an oblique position by the draw boy's hand, before they could be brought to act along with those in the centre, and consequently form a very irregular shed.

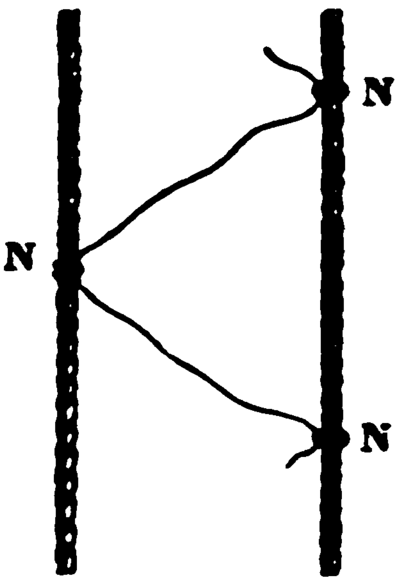
The heads N N N are small pieces of twine, which, as formerly observed, connect the lashes together and the gut cord on which they are made to slide up or down at pleasure; each lash having its respective head. These heads are made of foot twine when only few lashes are necessary, but of snitch twine when they are more numerous. The length of twine requisite for each head is from nine to ten inches; and when the two ends are laid together and knotted, the length in the double state will be from four to four and a half inches. The head is taken through a snitch formed by the loops of the lash, and is prevented from slipping by the knot on the end. On the loop end is formed a noose which runs on the gut cords.

The bridles K K, which are tied to the heads for the purpose of drawing the lashes down or up in regular succession, are made of snitch twine, and are commonly from nine to thirteen inches between the heads; the longer ones being necessary where the draw boy employs what is termed a *dog* or *devil*.

The gut cord L which extends from the floor to the ceiling of the shop, or at least to the height of the tail, is generally composed of three, four, five, or more smaller cords, laid together without any twist. Those made of cotton are preferred to those made of flax or hemp, on account of its softness, and having less tendency to cut the heads of the lashes.

For the smaller sized patterns, which require only a few lashes, one gut cord is fully sufficient; but when the lashes become more numerous it is customary to have two, and the heads are attached to them alternately, as represented in Fig. 68.

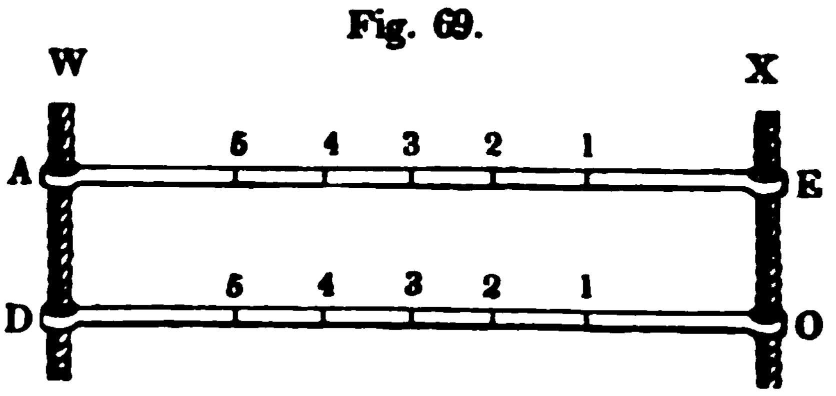
Fig. 68.



Moreover, all covered work requires additional gut cords, one for each cover or colour.

When four or more gut cords would be necessary, however, it is now common to employ only two, and to put on the lashes with cross bridles. These will be easily understood by referring to Fig. 69,

Fig. 69.



in which W, and X are two gut cords, placed at the distance of eleven or thirteen inches from each other, according to the number of covers or variety of colours in the pattern: the cross bridles extend horizontally from A to E or from D to O between the two gut cords, on which they can be shifted up and down by the draw boy at pleasure. They are made of seine twine, two ends laid together, and a knot tied for fixing the head of each colouring lash, at the distance of one inch from each other; those at the end being about two inches from their respective gut cords, as represented in Fig. 69,

by the Figs. of reference, 1, 2, 3, 4 and 5. Thus, if the lash at 1 were for green, at 2 for dark blue, at 3 for red, at 4 for yellow, and at 5 for light blue, then, when the draw boy takes down the cross bridle D O, on which there are lashes for all the five colours, and which he draws in succession, beginning with the lash 1 for the green, 2 for the dark blue, 3 for the red, 4 for the yellow, and 5 for the light blue; he then shifts down this cross bridle, and replaces it with the one marked A E: but on this the lash 4, for the yellow is wanting, so that he has only the lashes 1, 2, 3 and 5 to draw in succession on this bridle, for the green, dark blue, red, and light blue, respectively.

By referring again to Fig. 63 it will be observed, that as the twines incline from the harness board to the neck in very different angles, those towards the selvages, especially if broad harnesses, being much more oblique than those near the centre; it will follow, that when any portion of the simple cords is drawn down to form a shed, all the mails cannot rise to the same elevation; and, therefore, the sheds thus formed will be not only very irregular, but in many cases wholly impervious to the shuttle. To obviate this inconvenience, two wooden rollers are placed in each space between the rows of tail cords at the neck, or at the knots 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, one on each side of a row, and the ends of these rollers turn on two pieces of wood, one fixed on each side of the carriage at U O. By this means all the harness twines, however oblique, will rise vertically between the rollers, and consequently all the mails will be raised to the same uniform height in opening the sheds.

When the harness and all its appendages are completed, it is disengaged from the frame in which it was built; the frame of wood or justers which was fixed above the tail at W removed; the wire drawn out of the mails; and the slabstock taken out of the hangers. But in order to preserve the progressive order of the mails for drawing in the warp, a shaft or rod must be introduced into the place of the slabstock before it is taken out; by which means the mails will come to the weaver's hand in regular succession as he has occasion for them in entering his warp, without the necessity of having recourse to the harness board. The harness should now retain the very same position which it occupied while fixed in the frame, both with respect to the height of the mails and their distance from the yarn roll and breast-beam.

The process of drawing the warp through a harness does not differ from that formerly explained under tweeling, Figs. 18, 21, 24, 25, 27, 28, 29, 30, 31 and 32 (which see;) always drawing the

first thread on the back leaf, and so on to the front until the leaves of headles have been gone over; beginning again at the back leaf and drawing towards the front, and repeating the operation until the whole warp be entered. This is the case always in shawls, damask, and many other kinds of weaving. After the warp is taken through the harness, however, a new lease must be forced through the eyes or mails, from the rods behind, for the purpose of taking it through the ground leaves.

When the tail of a harness extends across the shop on the weaver's right hand, while on his seat, as in the example Fig. 63, it is termed a *right hand* harness; but, were the situation of the loom to require it to be tied on the opposite side of the shop, it would then be denominated a *left hand* harness; all the tail and simple cords would retain their relative positions and connections, only what is here the top of the pulley box would become the bottom. and the right hand side of the simple in the present case would become the left. This distinction must be particularly attended to in reading the pattern on the simple; which will be further explained under the head of *reading or lashing patterns.*

It may be again observed, that in Fig. 63 the tying of the harness commenced at one side, or at the figure 1 in the harness board in each part, and continued in regular succession till finished. This is the most common form of the harness, though other varieties are occasionally adopted. Had, for example, the mails numbered 1 in the two parts on the right, and those numbered 10 in the two parts on the left, been tied to the first tail cord or that marked 1 at the neck, and the others in regular order from the outsides toward the centre, this would be denominated a *gathered* harness; and would produce this effect, that whatever positions the patterns assumed in the two right hand parts, they would stand reversed on the other two; or, if stripes were to run diagonally from the right side in the former two, they would change their direction in the two latter, and meet in the centre of the web. In harnesses of this kind, however, it will always be found advantageous to terminate the tying with an odd mail in the centre, which prevents the appearance of teething.*

Again, were the same example (Fig. 63) to be taken for the bosom of a shawl, and that a border of fifty mails were to be added, it is obvious that an additional tail and simple of fifty cords each would be requisite; which would exactly fill the pulley box repre-

* A double point.

sented in Fig. 64; and the tie of the harness would be said to be fifty border and fifty body.

In this case the fifty pulleys in the back part of the box at A, B, C, D, would be appropriated to the border, and the remaining fifty to the body.

In tying a harness for shawls of this kind, the operator may commence either with the border or body. If he begin with the border the tail cord which passes over the first pulley, number 1 in Fig. 64, is tied at the first neck twine of each border or those at the extremities of the harness board at A and E (Fig. 66.) The second tail cord is tied to the second neck twine of each border, counting from the two selvages, and so on with the others till the borders be tied; observing, as formerly directed, that when the first ten cords in the pulley box are tied, to commence the second ten at the bottom of the box, and consequently the border will end at C. After the border is tied, the body begins with the tail cord which passes over the fifty-first pulley or the first in the body part, C, D, E, F, and proceeds in every respect as has been already explained.

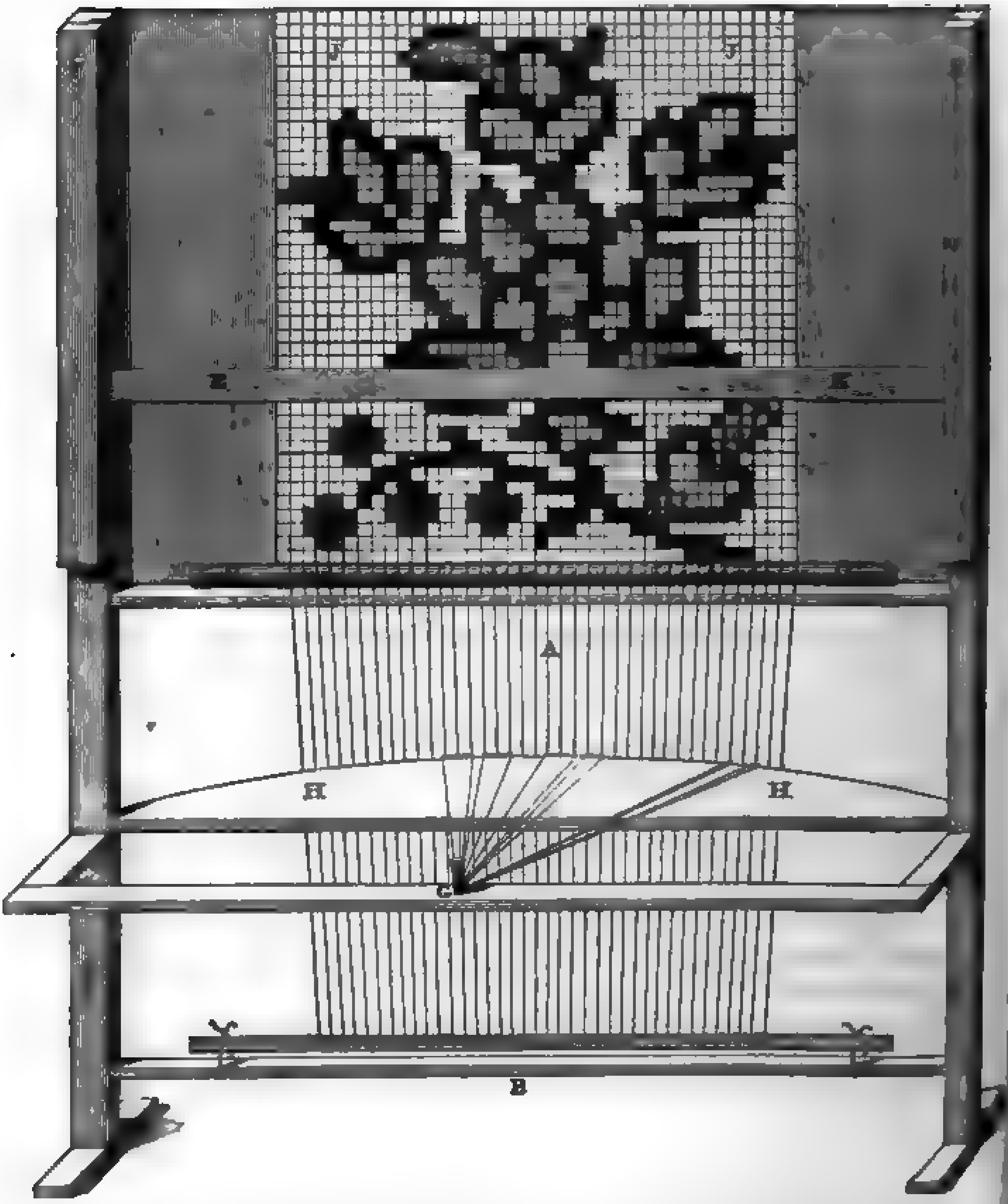
Had the tying commenced with the body, the process would have begun with the tail cord which passes over the first pulley at the corner of the box, or that which was last in the preceding method, and proceeded on in the contrary direction till finished; and then the border would begin with that tail cord which passes over the first pulley at the left hand in the sixth row, counting from the front; and in this case the harness twines nearest the selvages would be the last tied. Hence it is evident, that in tying the borders the right hand mail on one side, and the left hand mail on the other, are connected to the first tail cord; the second of each in succession, to the second tail cord, &c: but, in the body the tying of each part always commences at one side and proceeds regularly to the other, except in the case of a gathered harness, which would have continued inward to the centre, or outward to the selvages, in the same manner as the borders.

READING OR LASHING PATTERNS.

This operation, from the complexity of the patterns, and the necessity of accuracy, requires close attention.

The lower end of the simples A is fastened to the cross bar B in the reading or lashing frame, a very correct representation of which is given in Fig. 70,

Fig 70.*



and each simple cord is afterwards placed in a separate interval of the reed C C; which is open at one side so as to resemble a comb.

* We have been at great pains to make this machine (as well as all the others described in this work) worthy the attention of the manufacturers of this country; and we doubt not that our endeavors to please them in this particular will be properly appreciated. We have not slavishly followed in the

This reed must be made of such a fineness that each cord of the simple A may stand directly opposite to that space of the design paper to which it corresponds in the pattern, with allowance for one empty interval of the reed at the end of each design, but this does not appear in the drawing (Fig. 70.)* The pattern is now placed above the reed, as shown in the Fig. and over it the straight edge E E is made to slide up and down in grooves cut in the sides of the frame at F F.

These arrangements being made, and the straight edge E E fixed above the space of the design paper that represents the first lash, the operator fastens one end of the lash twine round the pin G, in such a manner that he can disengage it again at pleasure; then, after counting off such spaces at the left of the design as are to be omitted, if any, he takes a turn of the lash twine round the first parcel of simple cords that are to be taken for the lash, bringing the loop of the twine over the pin G; then round the next parcel of cords that are to be taken, and again bringing the loop of the twine over the pin G; and so on, alternately, until the lash be completed; taking care at the same time, never to take above six or seven cords of the simple into one tack or loop of the twine; for, when a greater number of cords come together they must be divided into different tacks, not exceeding either of these numbers in each. After the lash has been applied in this manner, the two ends of the lash twine are knotted together, close to the pin G; which is now taken out, and the loop that it has formed is twisted round and made into a snitch, for the purpose of fastening it to the head. The lash is now pushed down behind the board H H, to make room for another.

In the example given in Fig. 70, the pattern J J would require a simple containing 38 cords, as it consists of that number of small squares in the breadth; and as there are six colours in it, we shall suppose cross bridles to be employed. It is placed in the frame and adjusted to the simple, as already mentioned. The lasher, after fastening one end of his twine to the pin G, counts off 30 cords at

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track of our predecessors by copying verbatim the matter furnished by men totally incompetent to the task. We have spared neither expense nor labour in endeavouring to make this Work, in all respects, of sterling utility; and we rest our case in the hands of practical weavers and manufacturers.

* It is customary to have 9 dents in the reed or comb, C C on the same space as one of the designs, 8 by 8. This enables the reader or lasher of the pattern to leave every ninth interval of the reed empty, and thus to distinguish more easily the termination of each design. The same principle is applied whatever be the kind of design paper used.

the left side of the simple, corresponding to the 30 blank spaces or ground on the first line of the pattern at the bottom ; then takes a turn of the twine round the next 5 cords, which are black ; brings the loop over the pin G ; and passes the 3 last cords, which are blank. The two ends of the lash twine are now to be knotted together ; the pin G taken out ; the loop twisted ; (it is unnecessary to twist a lash of one tack, although all larger ones require it) and the lash put upon the first head of the bridle, or that marked 1, (Fig. 69 ;) which bridle being thus finished, as there is only one colour in the first line, is then put behind the board H H. The second line contains two colours, red and black, and after the straight edge has been shifted to its proper position for this line, the lasher again proceeds with the black by passing 19 cords to the left and taking the twentieth ; he passes the next 8 and takes 5 which are black ; and as the last 5 on the line are blank, they are likewise passed ; and the lash, being completed, he attaches it to the first head of the second bridle, as formerly. The red lash on the same line is now to be formed. He passes three cords, and takes 2 red ones, which follow ; and this finishes the second line of the pattern, as the rest of it is all ground, except the black, which was taken in the previous lash. He fastens the red lash to the second head, or that marked 2 on the second bridle ; which bridle he puts behind the board H H, as he did the first ; and so on till the pattern be finished ; bearing always in mind, as before observed, *that every colour must have a lash exclusively to itself, and they must all be drawn in regular order by the draw boy.*

By looking over the pattern it will be noticed that there are two cords of green on the fourth line from the bottom, in addition to the black and red, so that there must be three lashes on the corresponding bridle. On the fourth line there must be four, as the blue comes in extra upon it ; and on the sixth line five will be required, as it contains two cords of yellow. The pink begins on the seventeenth line, and, as all the colours are upon it, there will be six lashes on the bridle.* The ruler E E is represented in the drawing as being just above the twelfth line, which only contains black and green, and consequently but two lashes will be necessary for this line.

* In Fig. 69 only five heads are represented on the cross bridles, although there are six colours in the pattern, Fig. 70 ; but, of course, the operator will use as many as he has covers or colours in his pattern.

Although, in these examples, the instructions are given to take the painted parts of the design, yet in some cases it is of advantage to the weaver to take the ground simples or the blanks, and pass the painted parts, especially when they are heavier to draw than the ground; and in others, it is absolutely necessary, as in shawls for instance, the pattern of the side borders of which is thrown up by the warp, and of the cross borders by the weft; for in the one the flower is taken, and in the other the ground.

It may be here observed, that the cross bar or board H H in the frame, should be somewhat circular at the back, that when the simple cords are spread round it, the lashes may be all of an equal length from the simples to the pin G; The board H H should be moveable in the side pieces at I I, so that it may be regulated according to the intended length of the lashes.

The loom is worked by two persons, one of whom pulls the lashes and simples to form the pattern, and the other manages the treadles, shuttles and lay. The ground mounting is exactly the same in every respect as in damask weaving, (which see,) and the number of leaves is, of course, equal to one set of the tweel. For the ordinary quality of damasks five leaves are commonly used,* as at K K Fig. 65; but many of the finest are wrought with eight.

The person who pulls the lashes draws the first bridle down; and then, by pulling the simples of the first lash, and consequently the tail, raises that part of the harness which is attached to the latter: the weaver then works until a change of the pattern becomes necessary; the draw-boy slacks those cords of the simple which he last pulled, and pulls the simple cords of the second lash, as before: the weaver proceeds to work until another change is required; and so on to the end of his pattern.

When the mounting of the draw loom is very extensive, it is found necessary to employ from two to ten, or more, boxes of pulleys, and as many draw-boys; for, were the whole number of pulleys placed in one box or frame, it would be extended to a very *inconvenient* size. These are placed parallel to each other, and an equal portion of the cordage is conducted over each.

SCOTCH COUNTERPOISE HARNESS.

The next weaving machine, in order, which merits our attention is that invented by the late ingenious James Cross of Paisley (Scot-

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* In this case these form what is generally called a *bastard* tweel.

land.) This machine is known by the name of "Cross's Counterpoise Harness;" and its object is to supersede the use of draw boys. In the various branches of figured work to which the draw loom is applicable, this object has long been a desideratum; and many attempts have been made, especially in Scotland, towards its accomplishment, but nearly all of them have either proved abortive, or at least have been confined to particular branches of the manufacture. Since the introduction of the Jacquard machine into England by Stephen Wilson, (brother to Samuel Wilson, late Lord Mayor of London,) even Cross's machine seems to have gone out of use; but from its great ingenuity, and evident utility, *in many respects*, we have neither spared trouble nor expense in preparing new drawings, and in remodeling the description of it, from the original account given in the Edinburgh Encyclopœdia; and we trust that these will enable the reader to comprehend with ease its various parts, both in detail and in combination.

This machine consists of three distinct parts; one properly called the counterpoise harness, another, an apparatus for preparing the lashes, and the third, a treading machine. Fig. 71, is a front elevation of these three parts connected together as they stand in the loom when it is at rest. The harness F is in all respects like that of the common draw loom, already explained, till it reaches the neck, where the counterpoise apparatus commences. The principal part of this apparatus is contained in the upright frame AA, and the whole is supported by the carriage E E, which rests on the capes of the loom, as in the common draw loom. In the frame A A are four boards *e*, *u*, *v*, *i*, which are perforated with a number of corresponding holes, equal to the tie of the harness or size of the simple. The two boards *e*, *i*, (the top and bottom ones) are mortised into the cross rails *d*, *d*, which are let into the upright frame A A; the former called the suspension board (the top board *e*) from its bearing the weight of the harness and leads, and the latter (*i*) the neck, or directing board, as it answers the purpose of rollers, as well as keeps the cords at regular distances. The other two boards *u*, *v*, are called trap boards, and are mortised into the moveable bars *m*, *m*, called the arms of the trap boards, have their holes of a sufficient size, about a quarter of an inch in diameter, to allow the knots on the cords *o*, to pass freely through them; and at the side next the simple, there is a saw draught, or cut in the edge of each hole, to admit the cords, but to support the knots as represented in Fig. 72.

Fig. 71.

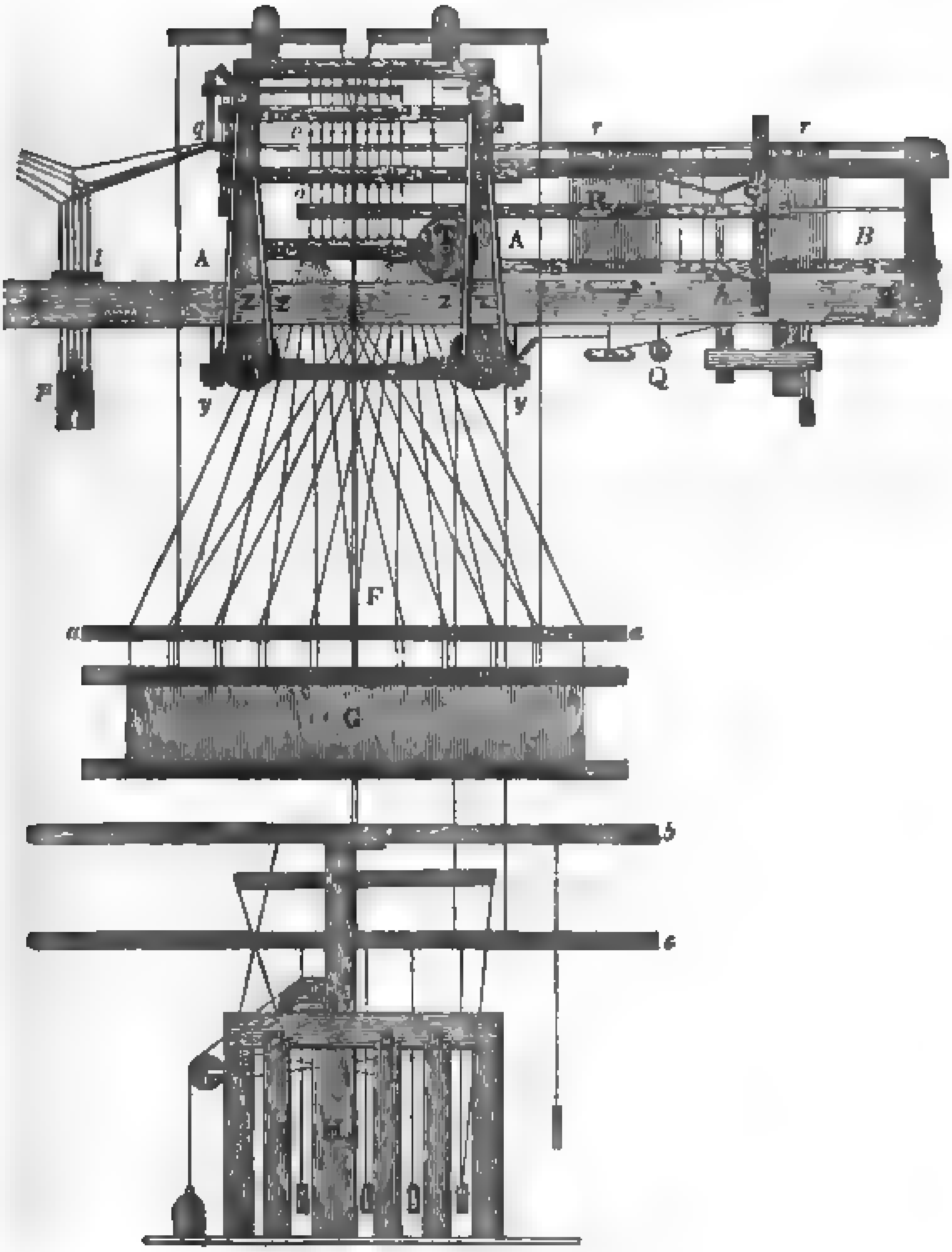
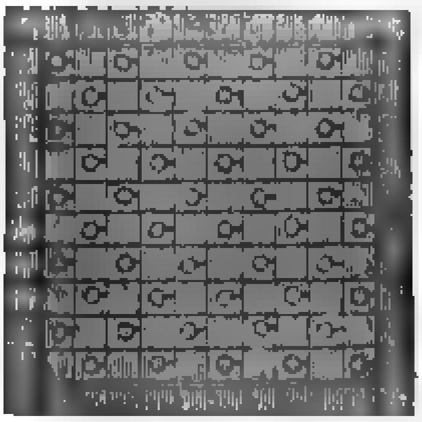


Fig. 72.



They are fastened to the suspension or top board *e*, by means of the holes made for that purpose, and are taken down through both of the trap boards to the neck *i*, where they are tied to the harness. K K are two circular pieces of wood, called rotators, which revolve on iron axles, that run through to the opposite side of the frame E, where other rotators are similarly fixed. *z*, *z*, *z*, *z*, are small bars or arms of wood, called pushers, and which connect the trap board arms to the rotators on each side of the frame E. The rotators K K are connected together by means of an arm or rod (one on each side of the carriage) and a small leather belt or strap at each end of it, which takes a turn round each of the rotators. The connecting arm or rod is placed just above the rotators, and works in a guide, which allows it to slide to the right or left, according to the alternate motion of the rotators, so that whatever motion is communicated to any one of these, it is instantaneously transmitted to the other, and thus a uniformity of action is constantly kept up. L is a bar of wood, with a corresponding one at the other side of the frame, on which the axles of the rotators revolve, and their height is regulated by the nuts and screws *y*, *y*.

The process of tying the counterpoise is the same as in the common draw loom; for the workman commences tying at the back row of the holes in the neck board *i*, and the other rows follow in succession; always beginning each row at the same side of the board at which the tying commenced, as from *a*, to *b*, if it commenced at *a*, &c. as in the pulley box of the draw loom (Fig 64.) In the Fig. 71 there are only two of the knot cords tied to their harness twines F, the first and last of each row, to prevent confusion. *a*, *a*, is the harness board, G the headles, and *b*, and *c*, marches.

Now, it is evident, that when the rotators K K are turned round to the right, which is effected by means of a cord connected to a treadle, the pushers *z*, will raise the upper trap board *u*, and sink the under trap board *v*; and when the rotators are turned the contrary way, the motion of the trap boards will be reversed. Consequently, were a portion of the knot cords drawn into the saw-draughts of one trap board for one lash, and the knot cords of another lash into the other trap board, *one spotting shed would be rising while the preceding one would be sinking;* and this is the principle of the counterpoise harness.

The next part of the machine is that for drawing the knot cords into the saw cuts, and is chiefly contained in the frame between A and B (Fig. 71.) In this apparatus, the simple *r*, *r*, is extended horizontally at the top of the frame AB, each simple being tied to

its respective knot cord above the neck: afterwards it is continued, by the addition of other pieces of twine to *q*, where it is supported by a half leaf of headles, and again to the wall or shop window, where the ends are fastened. At *p* are leads, one attached to each cord, to recover the knot cords after the draught, and *l*, a board with holes in it for regulating their distances. *s*, *s*, are gut cords for keeping the heads of the bridles open for the hooks. S^2 is the lash driver cross-piece, and R the shaft which communicates the motion from the pulley T, which is operated upon by a treadle, and on the axle of which are a number of eccentric pulleys, one for each cover or colour, for gaining power in the preparation of the lashes. The form of these pulleys, or rather tappets will be seen at Fig. 73.

Fig. 74.

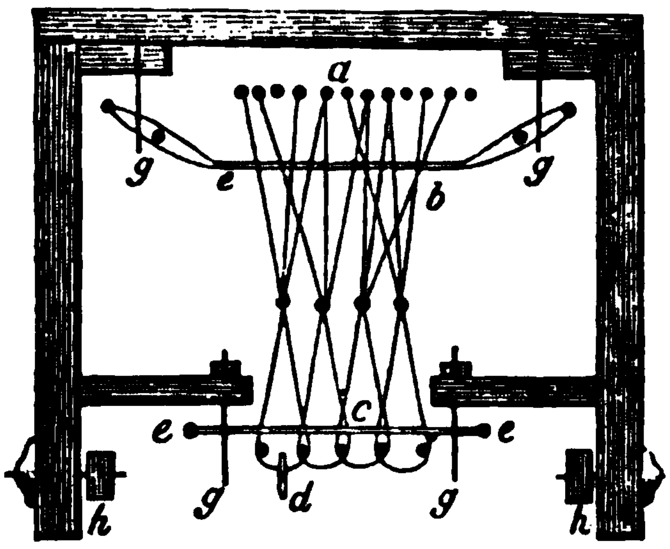
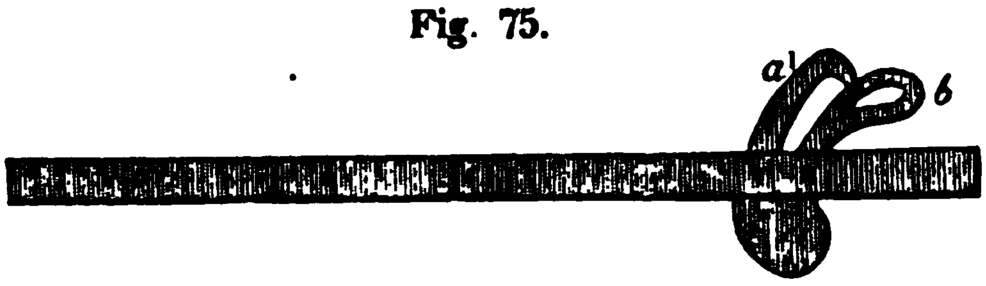


Fig. 73.

Fig. 74 is a front view of the lash driver; showing likewise the manner in which the lashes, simple, and cross bridles are connected. The dots at *a*, represent the ends of the simple, *b* the lashes, *c*, the heads of the lashes, and *e*, cross bridles. The position of the hooks a^1 as seen in Fig. 75,

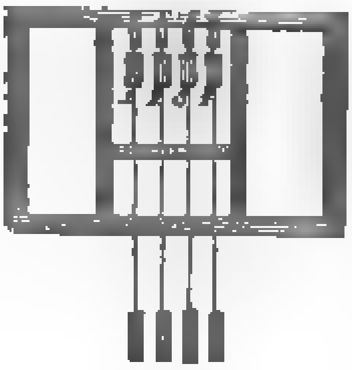
Fig. 75.



for drawing the lashes is pointed out at *d* (see Fig. 74.) *g*, *g*, *g*, *g*, are iron pins which drive the lashes to their proper place for the draught or opening of the shed. *h*, *h*, are the small castors on which the lash driver moves. Fig. 75 is a view of one of the tumblers or levers, in which is fastened the hook a^1 for pulling down the lash. The two parts a^1 and *b*, as seen in Fig. 75, are opened by cords connected to the treadles when they are in the position to catch the head of the lash, but shut again by their own gravity, as in the Fig. before the lash is pulled down. There is one of these levers for each cover or colour. P (Fig. 71) is the frame in which

these levers are placed, and which will be seen to more advantage at Fig. 76,

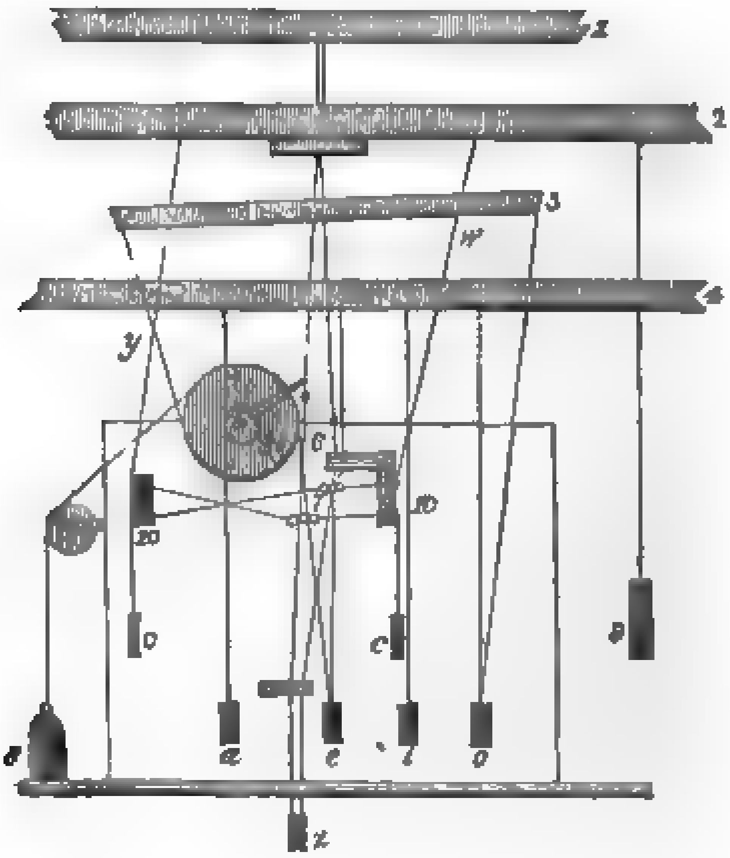
Fig. 76.



where 1, 2, 3 and 4, are the ends of the levers, and the small pulleys *i*, have cords running over them, to recover the levers after the lash is drawn. *h* (Fig. 71) is the escapement for opening the hooks, and allowing one set of lashes to escape and another to enter. Q (Fig. 71) is a roller flattened on one side, to allow the levers to play when the machine is working. This roller has a string connected to the escapement and another to the hook presser. In the hook presser are wires fixed that press on the under part of the hooks. These different parts are put in motion by means of treadles and marches, as in the ordinary way of mounting fancy looms.

The treading machine is next to be explained; the frame of which is seen at H, Fig. 71, but the several parts are more distinctly represented at Fig. 77,

Fig. 77.

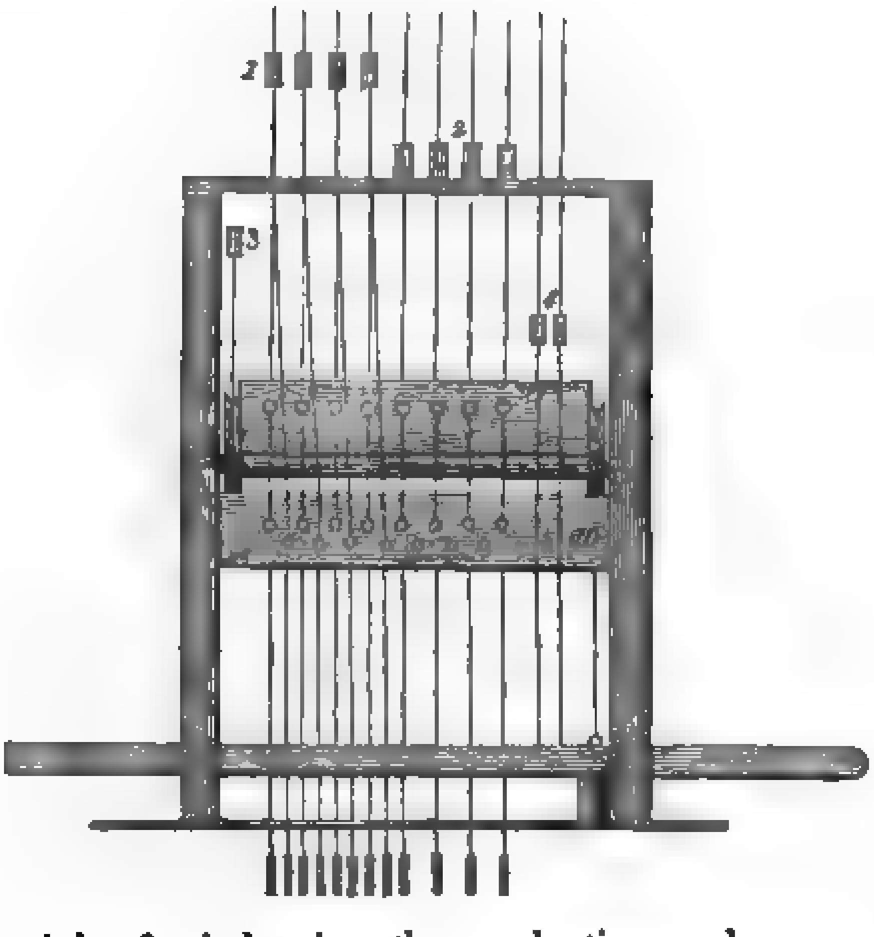


the principal of which are as follow: 1, is a knee shaft; 2, short marches, one for each leaf of the ground harness or headles; 3, a couper for turning the trap board 5; 4, a long march for working the drawing machine. *a*, *e*, *i*, *o*, are the ends of the treadles: *a* is for opening a flowering or counterpoise shed. 5 is one of the wheels or pulleys of the trap boards, represented at *c*, Fig. 78.

Fig. 78.

6 are the knots (see Fig. 77,) on the raising and sinking cords, and 7 are mails attached to them. 8 is a weight for recovering the machine, and 9 are weights for balancing the mounting, (see Fig. 77,) 10, 10, are boards pierced with holes for conducting the knot cords, one of which is seen at 10, Fig. 79.

Fig. 79.



c, *c*, are weights for balancing the conducting cords; *w*, a cord for conducting the pressing knot cords; *y*, for conducting the raising

knot cords, and *z*, weights for keeping the knot cords tight, (see Fig. 77.) *a*, Fig. 78, is a view of the trap board, and *b*, of the pressing board, each with their holes and saw draughts, where the knot cords play. Fig. 79, is a side view of the machine, in which 1, 2, 3 and 4, are the ends of the shafts, marches, and couper, represented in Fig. 77, with the same figures of reference. The tweeling cords are tied to the marches 2, brought down through the board 10, (see Figs. 77 and 79,) and attached to the mails 7, which guide the knot cords into the saw draughts. These cords are arranged according to the plan of the tweel to be woven. As *o* and *e* (see Fig. 77) are the two treadles for the ground, when either of them is pressed down, the pulley 5 is turned round, and opens a shed, and while one foot is tread, the other prepares the knot cords for the next change of pattern to be woven, &c.

DESIGN AND COLOURING.

"Learn hence to paint the parts that meet the view
In spheriod forms, of light and equal hue:
While from the light receding or the eye,
The working outlines take a fainter dye,
Lost and confused progressively they fade,
Not fall precipitate from light to shade;
This nature dictates, and this taste pursues,
Studious in gradual gloom her lights to lose,
The various whole with softening tints to fill,
As if one single head employed her skill."

Du Fresnoy.

Mr. Smith, one of the principal silk merchants in London, stated in his evidence before a committee of the House of Commons, that in fancy silks the superiority of the patterns in French fabrics, occasioned the sales to be in the proportion of one half or more over the English; that in fancy ribbands, three-fourths of those sold were of French manufacture, and obtained public favour solely on account of superior design.

James Skene, Esq., of Rubislaw, secretary to the Board of Trustees for the encouragement of manufactures in Scotland, says, "It appears to me that one thing in which the British manufacturer is most deficient is, a knowledge of colours. At present, as far as my acquaintance with manufactures goes, I believe they copy their patterns entirely from France; in doing which, if they introduce any alteration, they often spoil them; and we know quite well that any deviation from the regular established and fixed rules to harmonize

colours, produces the same effect to the eye, as any deviation in music from the harmony of notes: and, in placing our manufactures or fancy goods, along with French fancy articles of the same nature, it has often struck me as a remarkable circumstance, to see how very little those rules, which are exceedingly simple, are attended to in the English copies." See page 495.

Mr. Crabb, a designer of paper hangings in London, states, that the designs of the French room papers are superior in accuracy of drawing to those of the English: and that the colours are arranged upon some fixed principle by the French artisan: while in Great Britain, the workmen, not being sufficiently instructed, labours more at random until he obtains the effect he wishes, and this may be as often wrong as right.

Charles Toplis, Esq., a vice president of the London Mechanics' Institute, and one of the directors of the Museum of National Manufactures, says, "Many important branches of manufacture call for careful cultivation of the eye, for the purpose of arranging, assorting, and contrasting colours; which as an affair of taste, calls for some portion of a painter's education." And he adds, "whatever partakes of the nature of ornament, will only be appreciated in a refined eye, as it is characterised by grace and elegance of design; and by delicacy and precision of execution."

It is no doubt true, that the cultivation of the fine arts will, in course of time, improve the perception and taste of a nation, from the highest to the lowest grades of society; this is, however, the work of ages: but the present state of our British manufactures demands an *immediate* improvement in this particular.

We believe this want of ornamental designers to arise as much from the nature of the instruction given, as from the want of opportunities afforded for study. It is seldom that the young men who are admitted to our drawing academies, consider their studies as merely intended to improve them in the useful arts to which they may be bred. They almost always imbibe the idea of rising into a higher sphere, and seem to have no other ulterior object in their studies, than to leave their humble calling, at the conclusion of their apprenticeship, and become artists.

We speak from particular facts which have come under our observation.

Many an industrious young man, of ordinary talent, but possessing sufficient to have raised him to the head of ornamental painting, we have known to sacrifice himself to a life of penury and neglect, from this vain idea.

Various reasons may be assigned for the prevalence of this mania among young men who have had opportunities of studying the art of drawing: the flattery of their friends; injudicious patronage; the desire to become, by the quickest and easiest means, a gentleman; and many others, over which no national institution can have any control.

The most prominent cause, however, seems to be, that nothing is reckoned a work of art unless it be a picture. No matter how superior an ornamental design may be, or how much study or knowledge may have been required to produce it, still the production of such, although it may increase the wealth of the individual, cannot raise him one step in the scale of society; he is only a mechanic in the eyes of the public.

On the other hand, no sooner does the youth lay aside his useful implements, and dash off upon canvass something like a landscape, often with no eye to nature, but in servile imitation to some popular painter, than he seems to be by common consent raised to the dignity of *artist*. In short, those branches of the fine arts that are applicable to manufacture and other departments of useful industry, do not obtain in Great Britain that relative situation to the more intellectual and higher branches, to which they are fairly entitled. The case is different in Italy, for in the Academy of the Fine Arts at Venice there are distinct professors in the following departments of art: Architecture, Painting, Sculpture, Engraving, Perspective, and Ornament, and that in this latter branch the pupils are so numerous that the professor requires an assistant. Their examples are not only the best ornamental models of antiquity, but fruit, flowers and foliage. Every fifteen days they are each required to make an original design, within a given number of hours, precautions being taken to prevent deception; and, according to its merits, advancement and preference are bestowed.

A learned writer states that "the town of Lyons is so conscious of the value of such studies that it contributes 20,000 francs per annum to the government establishment of the school of arts, which takes charge of every youth who shows an aptitude for drawing or imitative design, of any kind applicable to manufactures. Hence, all the eminent painters, sculptors, even botanists and florists of Lyons, become eventually associated with the staple trade, and devote to it their happiest conceptions."

The Chinese seem to surpass all others in directing the studies of their youth distinctly to their ulterior object.

A writer on painting, in "Arnold's Library of the Fine Arts,"

mentions having seen, in the city of Pekin, a drawing book with progressive examples, where the separate character of land and water, rock and foliage, are given in perfect detail; and to these were added implements of various kinds, with figures, separate and in groups, all highly picturesque; and adds, that the objects of all these preparatory studies of the pupil was to enable him to paint a *fan*, which was the last example given.

We feel quite assured that were a similar course followed in our British Academies, a sufficient portion of that genius which at present seems to be all flowing into one channel, would, like a mill race taken from a river, be directed from that which is merely ornamental to that which is essentially useful and beneficial to the country. Art would not suffer from this, on the contrary, where real genius was discovered the facilities for encouraging it would be much greater; and we should have less of that misapplied and often selfish sort of patronage which fosters ordinary talent until it is fictitiously raised to where it cannot stand, and is then by the desertion of such injudicious patrons allowed to fall far below its own natural level.

We have attributed selfishness to some of these pretended patrons of art, for we know that they are often actuated by that feeling.

They cannot bring their minds to encourage those who have really proved themselves to possess the qualities which constitute the real artist; the works of such are too expensive, because their real value is known. Their proteges are the undeveloped, and they procure the early attempts of such for a mere pittance. They calculate that these embryo artists are all to be Rubenses in their day, and that their early productions will, like those of such great men, consequently become highly valuable. In many cases too injudicious patronage is the means of fostering mediocrity, which, assisted by other circumstances, is sustained in a situation injurious to true art. This is well known and much lamented among artists themselves, we mean such as really deserve the name; hence the necessity of national institutions, where merit alone will receive patronage, and be honoured by the approbation of those who are most capable to be its judges.

But, to return to our subject,—notwithstanding the superabundance of mediocre artists, it must be admitted, that there is a want of proper instruction in the art of drawing where it would be of most service; namely, in the populous manufacturing districts; and as this book, being adapted to the improvement of manufactures, may probably find its way into these quarters, we shall add a few hints

for the assistance of such as wish to commence this pleasing and useful study, and who may not have had any previous instructions.

The best kind of study to begin with, for those who intend to direct their attention merely to ornamental designs for manufactures, is that of flowers and foliage. When they are perfect in that branch, they may then soar higher if they please. It is the fault of most students of drawing to begin at the wrong end of their studies, by attempting difficult subjects before they are capable of drawing a single correct line, (it is for a similar reason that we have given in this work so thorough an analysis of plain weaving) and this want of knowledge of the *first elements* generally sticks to them through life; for, in very few instances do those who neglect the attainment of such knowledge at the outset ever descend to the drudgery of doing so afterwards.

INSTRUCTIONS IN ORNAMENTAL DRAWING.

A knowledge of drawing is, next to reading and writing, an essential branch of education for the manufacturer and mechanic, and to every one a source of enjoyment. The course of study we are about to point out is within the reach of all, even those in the most humble situations of life. They will find it of easy acquirement, and a source of continued enjoyment, in the improved medium through which it will lead them to view the most ordinary productions of Nature. She shall be their instructor, for all that we can pretend to do is to point out to them a practical mode of receiving her lessons.

In the first place, let your attempts be of the most simple kind, and on as large a scale as you can conveniently adopt. Therefore, begin by procuring a black painted board or slate, of from two to three feet square; and with white chalk practice the drawing of squares, circles and ovals, without any guide to your hand. Make copies of these figures by the ordinary rules, and when you are pretty perfect at these, upon the proper combinations of which depends all linear harmony, you may practice in the same way triangles, hexagons, octagons, and such other figures as arise from the various combinations of the straight line. Next, by your circular and oval lines, you may form crescents, circular and flattened volutes, regular undulations, and other figures which arise out of their various combinations; first making an accurate copy of each figure by

measurement, and continuing to practice until you can form it by the eye with perfect ease. Avoid forming your figures by little bits at a time: do each line, as much as possible, by one sweep of the hand. When you have become expert in this kind of practice we would recommend you at once to draw from nature. You may take for your first subject a pumpkin leaf, the larger the better, and persevere in copying it full size until you can represent it accurately in outline with its principal fibres. You may then vary your practice, by adopting other simple subjects of a similar kind, until you find you can do them all with ease.

Before endeavouring to draw more than one leaf at a time you must know a little of perspective. The most simple mode by which you will obtain such knowledge of this art as will be useful for your present purpose, is to hang a circular object, such as a hoop, between you and the window; set it moving gently round; recede a little from it, and you will find that as one side of it retires and the other comes forward, the circle which it describes becomes more and more elliptical until it disappears altogether, and leaves nothing but a dark line, as if a stick, instead of a hoop, were hanging before you. Fix it in various positions, and draw from it, and observe that the least movement changes its form. A knowledge of this simple fact is all that you require of perspective in the mean time. You may now hang up your pumpkin leaf, and you will observe the same change in its figure as it turns round. Make an outline of its shape while its front is half turned from you; then bring it from between you and the light and place it where the light will fall upon it with its face half turned from you, as when it hung between you and the window. Take your outline and within it draw the principal fibres as you see them. To do this properly will require a great deal of practice, but it will pave the way to your being able to draw the most complex groups of flowers and foliage that can be placed before you. You may now hang before you a small branch of any tree with a few leaves upon it, the larger the leaves are the better, and endeavour to make outlines of them, varying their shape according to their perspective, as already described; be particular on this point, for a great deal depends upon it. We once knew an intelligent Irishman so unaware of the simple fact of a circular object altering its shape by being seen obliquely, that he returned his portrait to have all the buttons made quite round; for although they appeared so at a little distance, he found by actual measurement that they were not like those upon his coat.

To gain anything like a tolerable accuracy in this, the first stage

of your lessons, may occupy from four to six months; that is, suppose you only practice at leisure hours.

You may now lay aside your chalk and slate, and provide yourself with a few sheets of common cartridge paper, and some pieces of charcoal; that made from lime tree is the best. Stretch a whole sheet of your cartridge paper upon your board, and make it fast by a wafer or a little paste at each corner. Place before you a cabbage, or any such large vegetable, and it will be more picturesque if the leaves are hanging loose. Copy these carefully in outline, using your charcoal gently, that any inaccuracy may be easily brushed off. We need not here remind you of what suggested the richest of pure architectural ornaments, the Corinthian Capital, a basket with a weed growing round it.

Your next practice should be light and shade. Bruise a bit of your charcoal to powder, take a piece of any kind of cloth upon the point of your finger, dip it into the powder and rub it upon such parts of your outlined sketch as you observe in the original do not receive the direct light of the window, and where it appears lightest touch your copy with your chalk, leaving the clean cartridge paper intermedially as a middle tint. Persevere in this sort of practice for some months.

For the coarse paper upon which you have hitherto practiced you may now substitute what is called drawing cartridge, which, instead of being merely fixed at the corners, must be pasted all over the edge: provide yourself with a black lead pencil, a swan quill hair pencil, and Indian ink. Commence, as formerly, by sketching your subject lightly with charcoal, as it is more easily erased, and when you have got your outlines quite correct, go over it with your black lead pencil. Rub down plenty of the Indian ink, for much of the freedom of your work will depend upon the wholesale way in which your shades are washed in. Continue this practice for six months before attempting smaller subjects than those we have described. You will now find little difficulty in copying the best examples of either ancient or modern ornament that can be laid before you; but flowers are your best practice. We cannot lead you further: you must go to a drawing master to attain a knowledge of using oil or water colours. But should your patterns be adapted for damasks only, you will have no use for this, unless for your amusement.

We are aware that this course of study would be useless to many, were the present style of patterns in their particular branches of manufacture to continue in fashion; for many of these designs are

a jumble of forms of the most nondescript nature. Improvement, however, is loudly called for.

To those who have gained a facility for copying the beautiful forms that prevail in the vegetable kingdom, and who have had such instructions in the use of water colours as may enable them to copy individual flowers with ease, we would recommend the acquiring of a thorough knowledge of harmonious colouring, (which see.)

The modes in which taste is cultivated at Lyons deserve particular attention, study, and imitation. Among the weavers of that city, (as well as among those of the other great cities of France) much attention is devoted to anything in any way connected with the beautiful either in figure or colour. Weavers may be seen in their holiday leisure gathering flowers and grouping them in the most engaging combinations. They are continually suggesting new designs to their employers, and are thus the fruitful source of elegant patterns. Hence, the French flower patterns are remarkably free from incongruities, being copied from nature with scientific precision.

All these facilities for the improvement of our fancy manufactures, which are now springing into existence in every quarter of this vast country, are within the reach of the most humble. The pursuit of such a course of study as we have endeavoured to point out, would not only augment their sources of innocent pleasure, but lead them to other instructive pursuits. The youth in searching for the most graceful and picturesque plants in nature's most profuse and wildest productions, would be naturally led to commence the study of botany; for, he would then have some interest in the enquiry. And, it may easily be imagined with what avidity the more advanced would add to their knowledge of that pleasing science, or the gratification they would derive from the study and practice of horticulture.

It is scarcely necessary for us to point out the advantages to be derived from the cultivation of flowers, by those engaged in designing ornamental patterns. The productions of a well managed flower garden to such would be, in our opinion, of more real utility as objects of study than the contents of the Louvre. In those productions of nature they will find most exquisite beauty and elegance of form.

In saying that the study of such subjects is of more utility to the ornamental designer than that of those great works of art which have been the admiration of ages, we do not mean to undervalue the benefit that any one, and especially the artist, may derive from studying works of this description. We are aware that the eye has

its principle of correspondence with what is beautiful and elegant, and that it acquires, like the ear, an habitual delicacy, and answers with the same provisions to the finest impressions. Being, therefore, versed in the works of the best masters it soon learns to distinguish true impressions from false, and grace from affectation.

HARMONIOUS COLOURING.

Harmonious arrangements of colours are such combinations as by certain principles of our nature produce an effect on the eye similar to that which is produced by harmonious music on the ear; and a remarkable conformity exists between the science of colour and that of sound in their fundamental principles, as well as in their effects.

It is well known to all who have studied music, that there are three fundamental notes, viz. C, E, and G, which compose the common chord or harmonic triad; and that they are the foundation of all harmony. So there are, also, three fundamental colours, the lowest number capable of uniting in variety, harmony or system.

By the combination of any two of these primary colours a secondary colour of a distinct kind is produced; and as only one absolutely distinct denomination of colour can arise from a combination of the three primaries, the full number of really distinct colours is seven, corresponding to the seven notes in the complete scale of the musician. Each of these colours is capable of forming an *archus* or key for an arrangement to which all the other colours introduced must refer subordinately. This reference and subordination to one particular colour, as is the case in regard to the key note in musical composition, gives a character to the whole.

This characteristic of an arrangement of colour is generally called its tone; but, this tone is more applicable to individual lines, as it is in music to voices and instruments alone. The colourist, like the musician, notwithstanding the extreme simplicity of the fundamental principles upon which his art is founded, has ample scope for the production of originality and beauty, in the various combinations and arrangements of his materials.

The three homogenious colours, yellow, red, and blue, have been proved by Field in the most satisfactory manner to be in numerical proportional power as follows: yellow three, red five, and blue eight.

When these three colours are reflected from any opaque body in these proportions, white is produced. They are then in an active state, but each neutralized by the relative effect that the others have

upon it. When they are absorbed in the same proportions they are in a passive state, and black is the result. When transmitted through any transparent body the effect is the same, but in the first case they are material or inherent, and in the second impalpable or transient.

From the combination of the primary colours the secondary arise, and are orange, which is composed of yellow and red in the proportion of three and five; purple, which is composed of red and blue in the proportion of five and eight; and green, composed of yellow and blue in the proportion of three and eight. These are called the accidental or contrasting colours to the primaries with which they produce harmony in opposition, in the same manner in which it is effected in music by accompaniment, the orange with the blue, the purple with the yellow, and the green with the red. They are therefore concords in the musical relation of fourths, neutralizing each other at sixteen. From the combination of these secondaries arise the tertiaries, which are also three in number, as follows: olive, from the mixture of the purple and green; citron from the mixture of orange and purple; and russet from the mixture of green and orange. These three colours, however, like the compounds produced by their admixture, may be reckoned under the general denomination of neutral hues, as they are all formed by a mixture of the same ingredients, the three primaries, which always less or more neutralize each other in triunity; the most neutral of them all being grey, the mean between black and white, as any of the secondaries are between two primaries, it may appropriately be termed the seventh colour. These tertiaries, however, stand in the same relation to the secondaries that the secondaries do to the primaries, olive to orange, citron to purple, and russet to green; and their proportion will be found to be in the same accordance, and neutralizing each other integrally as 32.

Out of the tertiaries arise a series of other colours, such as brown, marone, slate, &c. in an incalculable gradation, until they arrive in a perfect neutrality in black. To all of these the same rules of contrast are equally applicable.

Besides this relation of contrast in opposition, colours have a relation in series, which is their melody. This melody or harmony of succession is found in all the natural phenomena of colour. Each colour on the prismatic spectrum and in the rainbow is melodized by the two compounds which it forms with the other two primaries. For instance, the yellow is melodized by the orange on the one side and the green on the other, the blue by the green and

purple, and the red by the purple and orange. Field, in his excellent essay on the "Analogy and Harmony of Colours," has shown these coincidences by a diagram, in which he has accommodated the chromatic scale of the colourist to the diatonic scale of the musician; showing that the concords and discords are also singularly coincident.

An eminent writer on the fine arts observes, that colouring, like sound in music or poetry, should be an echo to the sense; and according to the general sentiment the subject should inspire, it will be gay, lively, sombre or solemn.

By keeping these observations in view, the pattern drawer will have an extensive field for the display of his judgment and taste, in the selection and arrangement of the harmonizing and contrasting colours, especially if he examines attentively, the order in which nature commonly disposes them. Thus, for example, in the centre of a red rose he will find a yellow tint blended with the orange hue of the stamens, while the petals or leaves of the flower are red. These tints, agreeably to the principles of which we have been treating, are harmonizing colours; while the calyx or cup, which comes in contact with the petals, as well as the other parts of the shrub are green, the natural contrasting colour of red. Examples of the contrasting colours on flowers will be found in some species of the violet, the wall flower, and many other productions of the flower garden.

In the finest specimens of Persian and Turkish carpets, the deep tones of indigo and brown predominate, while the bright hues and tints only appear in detail, and heighten the effect of the pattern.

For the majority of the foregoing observations on design and colouring, we are indebted to Mr. Hay's work on colour* the best and cheapest practical work on the subject, and one which to the professional man and to the student is indispensable.

DESIGN PAPER.

Patterns require to be painted on design paper before they can be lashed. It is commonly printed from an engraved copper or steel plate upon stout white paper: it consists of straight lines running at right angles; the spaces between which lines represent the threads of warp and weft.

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* The Laws of Harmonious Colouring. By D. R. Hay: W. S. Orr. 1838.

The varieties of design paper in common use are, 8 by 8, 8 by 9, 8 by 10, 8 by 11, 8 by 12, 8 by 13, 8 by 14, 8 by 16, and 10 by 10. A specimen of 8 by 8 is shown in Fig. 70, and it will be observed, as the name implies, that it has eight white spaces both ways in the design. In using these varieties for draw loom patterns, 8 is commonly considered the simples or mails in a design, and the variable numbers 9, 10, 11, &c., the lashes, to adapt the pattern either to the quantity of weft on the ground or the number of picks on each lash. In some cases, however, the variable figures represent the simple cords and 8 the lashes; which adds considerably to the number of varieties above specified. See page 507.

DESIGNING PATTERNS.

This is perhaps the most important as well as the most delicate process connected with figured weaving; for it is on a judicious selection and extensive variety of patterns, combined with economy in the disposal of colours, that the greatest chances of success depend. The manufacturer, therefore, though no designer himself, should possess a knowledge of drawing, or at least of sketching, so as to be able to communicate his ideas to the pattern drawer, and to make a tasteful selection from the productions of others.

The qualifications of a pattern drawer who would excel in his profession are by no means of a superficial nature. A facility in sketching or delineating any object that may present itself, whether natural, artificial, or imaginary, combined with a thorough knowledge of the principles of weaving, at least with those branches with which he is more immediately connected, are indispensable requisites. The pattern drawer, like the poet and the painter, ought to possess a strong and lively imagination, to be deeply impressed with the beauties of nature, and to be able to draw from thence the principal effect of his designs. A chaste taste also is as necessary in the pattern drawer as in the manafacturer; and this will be greatly improved by a little knowledge of geometry, particularly symmetry and proportion; for nothing can be more offensive to a person of genuine taste than a pattern crowded with an incongruous assemblage of distorted objects, as for instance, dwarfs, knockneed night owls, straight-legged curlews, crook-necked cormorants &c.

Pattern drawers have frequent occasion to copy extensive patterns from the cloth, such as coloured shawls, vestings and furniture stuffs. This is easily effected by laying a sheet of transparent paper over the pattern to be copied, so that every object and colour

may be distinctly traced through it with a black lead pencil. The pattern may afterwards be transferred to a sheet of clean drawing paper, by means of tracing paper, and a steel point, and coloured in the same manner as the original.

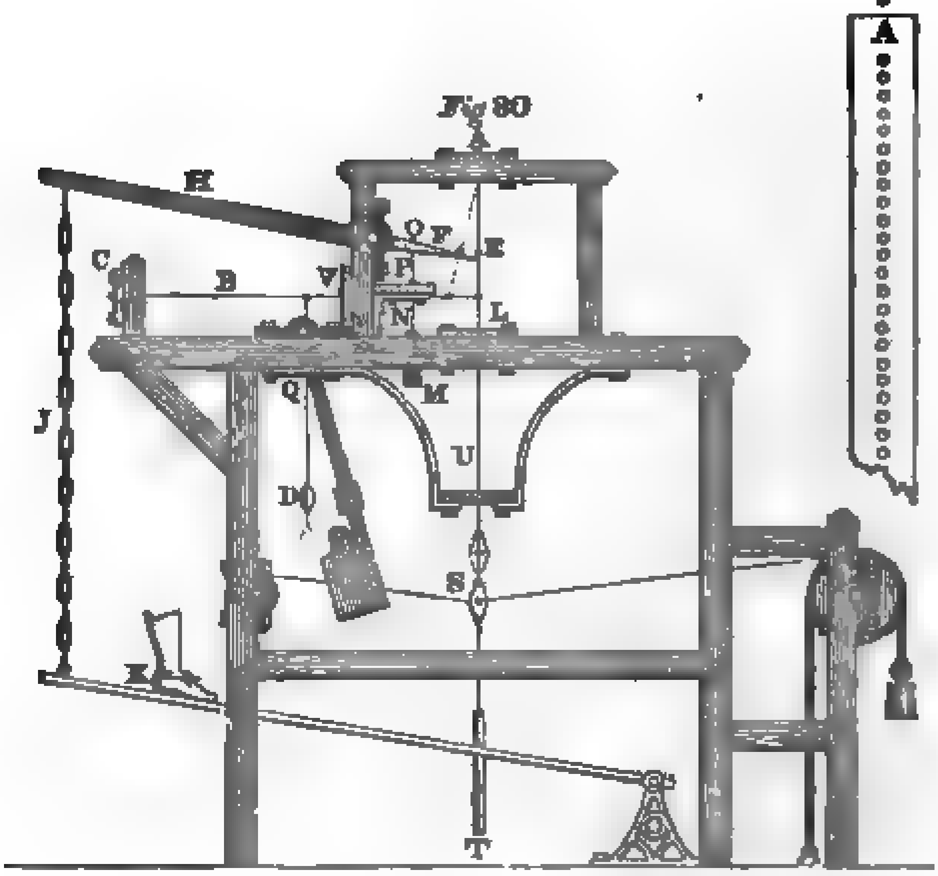
To make transparent paper, a sheet of silk or tissue paper may be brushed over with sweet oil, until it be thoroughly wet, and when it has been allowed to dry it will be fit for use. But, as this paper will sometimes become dim by exposure to the air, the following receipt is recommended:

Take one quart of the best rectified spirits of turpentine, and add to it a quarter of an ounce of sugar of lead, finely powdered; shake it up, and let it stand twenty-four hours; then pour it off (throwing away the sediment, of course,) and add to it one pound of the best Canada balsam; set it in a gentle hand heat till it is quite mixed, when it will be fit for brushing over the paper.

COMB DRAW LOOM.

Fig 81

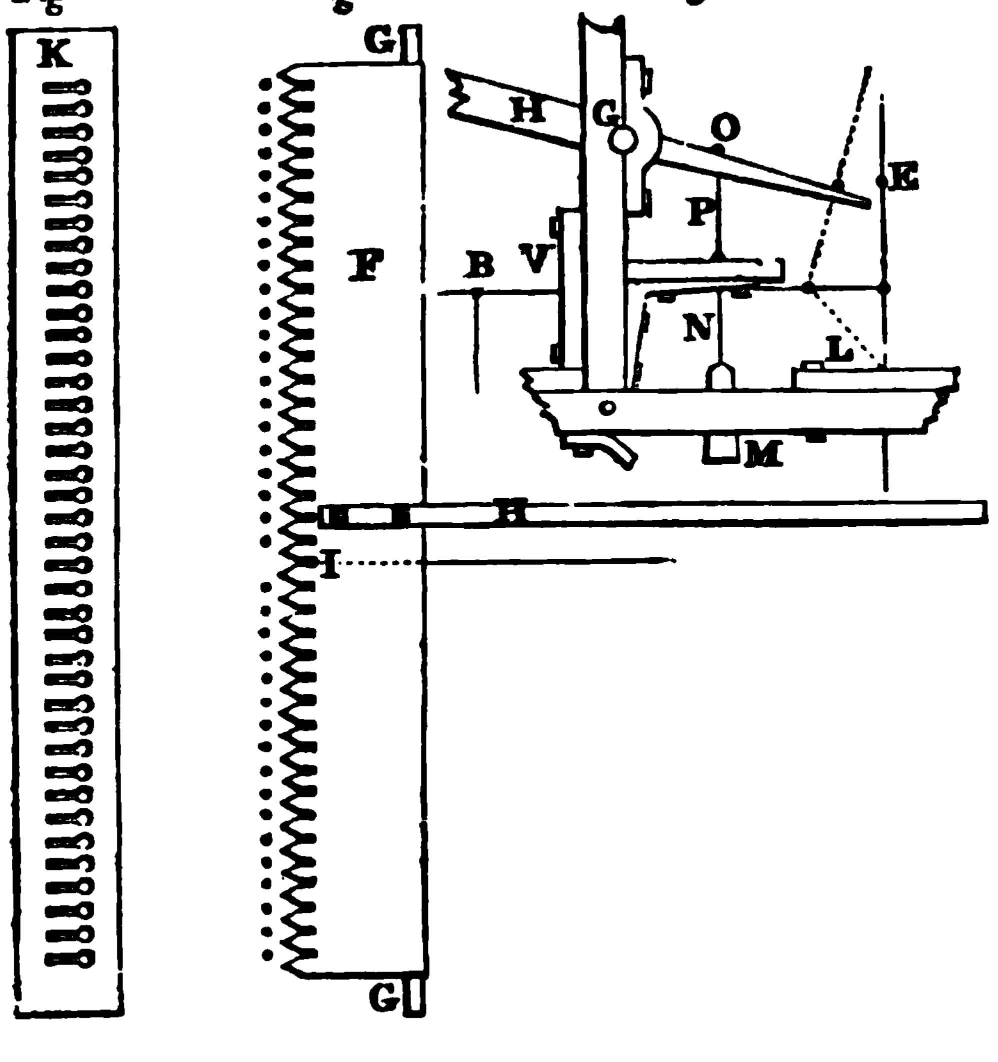
Fig 80



After the introduction of Cross's machine among the Paisley manufacturers, Dr. Laughlin Mc. Laughlin, of Ballyshannon, (county Donegal,) Ireland, made some slight alterations upon it, (for they can scarcely be called improvements,) in the mode of lifting the cords of the harness, by substituting a comb or combs, instead of trap boards, which were used in the original. In the

s modification, the tail is cut short, and the ends of the cords l perpendicularly in a board or frame, which is screwed or to the top of the machine, as represented at A in Fig. 80: view of this board is given in Fig 81. From each of these licular cords, a simple cord B extends horizontally over the 's head, (the position of which will be evident enough from tion of his leg seen in the figure,) and is fastened to the J, (which is precisely like that shown in Fig. 81,) the lashes g below, each having a bob D ready to be pulled by the 's hand, instead of by a draw boy. A little above the point the simple cords are connected to the perpendicular or neck here is a knot E on each of the perpendicular cords, all of knots are in a straight line, and of an equal height; and not differ from those marked O O in Cross's machine. Be-se knots and above the simple is placed, upon suitable bear-flat board F, moving upon pivots at G G, one edge of which nted so as to resemble the teeth of a *comb* (see Fig. 82) from useful family utensil, no doubt, it has derived its name. On of this board, opposite to the teeth, is nailed a long arm or (see Figs. 80, 82 and 84) which when pulled down raises ented side or teeth; and consequently the knot cords which een drawn into them, as is represented at I Fig. 82.

Fig 83 Fig 82 Fig 84



wire or chain J (see Fig 80) connects the arm H with the K, which treadle is distinct from those used for working the

ground. Hence, when any shed is to be opened, the weaver pulls down the corresponding lash, thereby drawing the knot cords attached to it, between the teeth of the comb F, as before stated; he then presses down the treadle K with his left foot, keeping it pressed until he has worked over the ground treadles, with his right foot, and given the proper number of picks for that change of the pattern. There is also another guide board, marked L, through which all the perpendicular cords E pass, and it is in all respects like that marked A Fig. 81. The comb F is recovered or counterbalanced to its resting place every time the weaver lifts his foot from off the treadle K, by means of the weight M and cord N, which cord passes into the comb F and is made fast by a knot at O. There is also another knot P on this cord, for preventing the weight M from sinking the comb F too low under the knot E: all this will be seen to greater advantage in the enlarged section Fig. 84. The cords of the lash bobs D have each a knot, which, when the bob is pulled down, is slipped under a saw cut or groove in the board Q, a more perfect view of which is given in Fig. 83. As many of the simple cords B are connected to each of the bob cords as are required to form one lash or change of the pattern, and of course, there must be as many bobs as there are changes in the figure.

We would remark, that in Fig. 80, only one mail S and one lead T are shown, to avoid confusion; but the harness does not differ in construction from that represented in Figs. 63 and 85.

SECTION SIXTH.

BARREL OR CYLINDER LOOM.

The next improvement in weaving that merits our attention, is that of the barrel or cylinder loom, the invention of which is claimed by one Thomas Morton, of Kilmarnock, Scotland. This improvement consists in using a barrel or cylinder, on the surface of which, the figure or pattern to be produced in the cloth is arranged in relief, precisely in the same way as tunes are disposed on the barrel of the common organ, or on that of a musical box, by inserting wire

staples or wooden pins, and the barrel being placed upon the top of the loom, these staples actuate other suitable mechanism, and thus the pattern is formed upon the cloth.

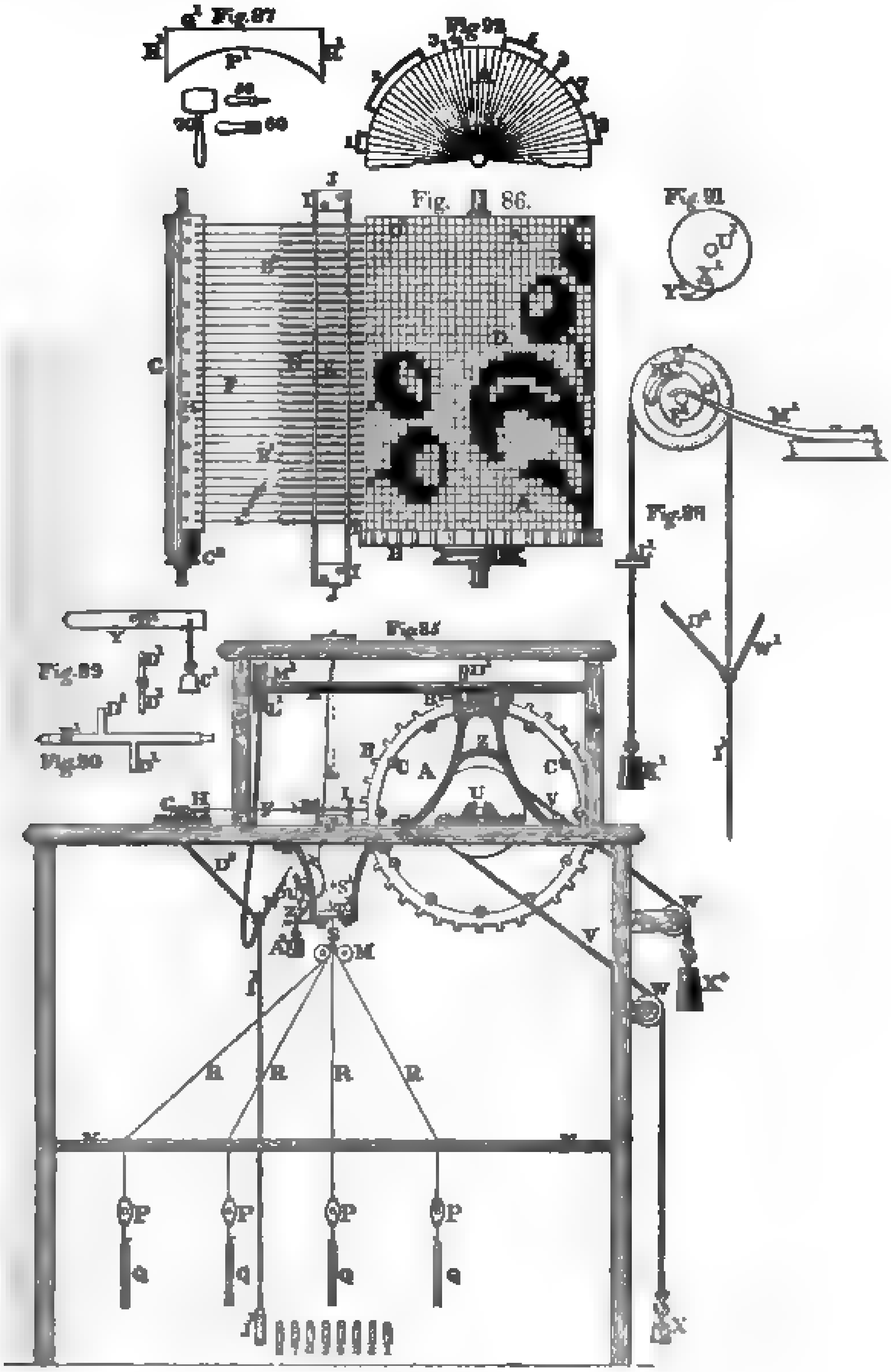


Fig. 85 represents a front view of this loom, as it appears when the shed is formed. A is the barrel; B a spur wheel fastened to its

end by the screws C C: this wheel, by means of proper catches and other machinery, to be hereinafter described, governs the rotation of the barrel A, so as to give out a line on its surface at each change of the pattern, equal to one line of the design paper, as represented in Fig. 86, which figure shows a plan of the barrel A, with the pattern or sprig D drawn upon its surface; E is the slides; F the connecting cords, and G the slide roller; the latter having a leather strap H nailed to it, in order that the cords F may be fastened thereto, as is shown in Figs. 85 and 86. The slides E work in the slide frame I I, an end view of which frame is given in Fig. 85, and a plan of it in Fig. 86; it is fastened at each side by the bolts or screws J J, which hold it in its proper place. Fig. 92 is an end view, in section, of the barrel A, having a few of the pattern staples driven into it, (by way of example:) these staples are of the various sizes or lengths to suit the number of changes required in the different parts of the pattern, as indicated by the sprig D, Fig. 86. The staple No. 1 (see Fig 92) contains three lines, and, of course, will cause the warp thread or threads which it governs, to be lifted three times in regular succession; the two lines which follow this staple, being ground, are missed, and ten lines* are taken for the staple No. 2; two lines are missed, and one is taken for No. 3; one line is missed, and one is taken for No. 4; four lines are missed, and six are taken for No. 5; one line is missed, and one is taken for No 6; one line is missed, and four are taken for No. 7; one line is missed, and five are taken for No. 8; and the two last lines on the right hand side are missed, being ground or blank.

The neck cords are arranged in a row, (similarly to those of Dr. McLaughlin's machine,) and each passes through a suitable hole in one of the slides E, which holes may be seen at K in the slide frame Fig. 86, and their position is indicated by the dotted line L, Fig. 85. The tail or neck cords are all tied to their respective harness twines immediately above the two wooden rollers M (see Fig. 85:) these rollers keep the selvage warp threads of the same height as those in the centre of the web when the shed is formed. N N is the harness board, which is supported by the framing of the loom at O O; P P P P are mails, and Q Q Q Q their respective lead weights, and both these leads and mails are precisely of the same form as those

* This is the greatest number, or length, ever taken for one staple; because, if more were taken, the staple would be liable to bend in its middle owing to the slides E driving against it in the working of the loom.

of the draw loom (shown in Fig. 63.) In Fig. 85 there are four harness cords, R R R R, connected to the first tail cord at S, just above the rollers M, which shows that in this example, there are four repeats or parts in the whole tie of the harness. The harness board N N is in every respect like that of the draw loom, Fig. 66, in which figure five holes are shown in the breadth of the board; one row, therefore, or five holes, may be supposed to represent five of the slides E, shown in Fig. 86.

Now, the operator, in proceeding to tie up a harness of this description, takes the first front hole of the board at the commencement of each repeat or part; and if it is to contain four repeats, as in Fig. 85, he connects those four cords to the first or front tail cord, and then proceeds to the second, and so on to the fifth or back hole in his harness board, which will, of course, be connected to the tail cord belonging to the fifth slide. For the sake of illustration, we have numbered these five slides in regular succession, No. 1 being the first in front and corresponding to the front hole in the harness board N N, and so on to slide No. 5, which corresponds to the last or fifth hole at the back of the harness board. When one row is finished, the operator again commences at the front of the harness board, on the right hand side of each of the first rows, tying the four first cords of the second row of each repeat to the tail cord passing through the sixth slide, and so on until the row be completed, always beginning the rows as at first, and proceeding regularly over them until all the harness is tied.

The pattern must be read off from the design paper on to the barrel A, as represented in Fig. 86; but, previous to this process, however, it is necessary to line off the barrel, so as to give its surface the appearance of design paper, and without which preparatory operation, the pattern could not be read on properly: this lining is effected in the following manner:—One of the slides E is sharpened to a point, as represented at T, Fig. 86, which point is kept pressed by the finger of the principal operator against the barrel A, while a second person causes the barrel to revolve, by which means, a mark or line is made round its surface, like those shown in Fig. 86. It may be observed, that none of the slides E are inserted in the frame I I until the barrel A has been chequered as shown in the figure; because, if they were, the pointed slide T, could not be moved along from hole to hole in the frame I I, as the marking or scoring proceeded. Each of the lines thus made round the barrel A must be directly opposite to the centre of a slide, in order that the slides may afterwards strike fairly on the staples.

The operator now proceeds to cross-line his barrel (from right to left) by laying a ruler or straight-edge along the length of it, parallel to its axis; the ends of which ruler rest on each side of the frame of the machine, and perfectly level with the slide frame I I. He affixes to the end of the barrel A a throated pulley U (See Fig 85,) around which is adjusted the rope or cord V V, passing over the pulleys W W, and attached to the weights X and X,* the latter of these weights being sufficiently heavy to draw round the barrel A one line of the pattern every time one of the catches Y Y (one of which is seen in Fig 89) is elevated from the side of one of the cogs of the spur wheel B. These catches are fixed in the stand or support Z, which is bolted to the frame at A^1 A^1 (see Fig. 85;) in this stand the catches are kept in the proper position, by means of a wire pin B^1 passing through them; a clearer view of one of these catches with its pin B^1 and recovering weight C^1 will be had in Fig. 89. The recovering weight C^1 of each catch merely serves to bring it back to its former position in the spur wheel B after it has been lifted by the arms D^1 D^1 of the tumbler E^1; this tumbler is distinctly represented in Figs. 85 and 90. On one end of the tumbler shaft is affixed a small pellet F^1, which works in a gouged-out pulley G^1 (see Fig. 88,) which pulley is loose on the end of the tumbler shaft, and a small spring catch H^1 is screwed to it, and this catch works against each of the points of the pellet F^1 alternately (see Fig. 88.) The operation of these parts is as follows:—

Every time the barrel treadle cord I^1 (see Figs. 85 and 88) is depressed, the pulley G^1 having the spring catch H^1 screwed to it will cause the pellet F^1 to turn to the right, and, if the treadle cord I^1 be of the proper length, the two points of the pellet F^1 will exchange positions. The cord I^1, being connected below to the barrel treadle J^1, as in Fig 85, when the weaver lifts his (left) foot from off this treadle, the weight R^1 will recover the pulley G^1 to its former position, as shown in Fig. 88, the spring catch H slipping over one of the points of the pellet F^1. The whole of the apparatus in Fig. 88 is kept in its proper position by means of the knot L^1. The spring M^1 bears against the tumbler shaft in such a manner that at whatsoever point or place the spring catch H^1 leaves the pellet F^1, it will there remain; and this prevents any part of the apparatus from interfering with the catches Y Y during the operation of the loom. The knot N^1 (see Fig. 88) holds the cord in the throat of the pulley G^1.

When the operator proceeds to line off or score his barrel lengthwise, as before stated, he lifts the catches Y Y, each alternately

and draws a line or score for every time a catch is lifted. The weight X^* causes the barrel A to move half a tooth or interval to each line only, and consequently each of the catches Y Y must only be half the thickness of one interval between the teeth or dents of the spur wheel B; for, if each catch fitted between two of the teeth, although one of the catches were lifted, still the weight X^* could not move the barrel A, as the other catch would hold it fast: and if both catches were elevated at once, this weight would instantly run down as far as the cord would permit, or until stopt by some other means, such as the floor of the weaving room, and thus spoil the operation, but to avoid this evil, each of the catches Y Y, as before observed, is only half the thickness of the space between the teeth or dents of the wheel B, and they are so arranged, that the one to the left hand side bears against the inside of one tooth and the other to the right bears against the inside of another tooth, thus leaving half a space empty inside of each catch, one tooth being in the centre between them.

Now, suppose the barrel A to be pulled by the weight X^* towards the right, as in Fig. 85, the tumbler shaft E^1 causing the left hand catch (which was inside the tooth and bearing against it) to be elevated, it is evident that the weight X^* would directly cause the barrel A to move half a tooth, by bringing the right hand catch against the left hand side of the tooth, instead of the right; and during these movements the first catch would recover its former position, by dropping into a new interval towards the left hand side, the weight X^* drawing the barrel against the other catch before the first had time to interfere by dropping into the place from which the second was moved: thus the gradual motion is communicated to the barrel A. The operator draws a line or score along the face of the barrel, parallel to its axis, every time he lifts one of the catches Y Y, until the entire circumference of the barrel be lined off.

Particular care should be taken, that the cross lines come directly in a range with the centre of the slides E, so that these may strike correctly on the staples or pins of the barrel in the operation of weaving; for, unless the slides strike correctly on the centres of the lines both ways, the pattern will be imperfect, as the comb will miss the knots of the tail cords (which part of the apparatus will be described hereafter.)

It is necessary to mark upon the barrel A a correct representation of the design or pattern to be woven in the cloth, such as is shown by the sprig D, in Fig 86. The sprig D is given, for the sake of

illustration, with the small squares filled up, as patterns are painted on design paper; but it is evident that the slides E could not strike the centres of those squares, their points being directly opposite to the lines which run round the circumference of the barrel A. The pattern, therefore, instead of being marked in the centres of the squares, like the sprig D, must be marked on the corners of them, or where the lines cross each other at right angles: a specimen of this marking is given at O, Fig. 86, which indicates by the dots the different corners or crossings where the staples are to be inserted. Before the operator drives in the staples, he takes a bradawl, such as that shown at 50, Fig. 87, with which he pierces small holes for the reception of the points of wire of which the staples are formed. The bradawl 50 is held in the left hand, and the mallet 70 in the right; and as soon as a staple has been driven to nearly its proper depth in the barrel, the operator uses the punch 60, which has a saw cut in its face sufficiently wide to admit the staple wire, (which is generally No. 13 or 14;) and, as the depth of this saw cut is exactly the same as the height to which the staples must project from the surface of the barrel, the punch is, therefore, driven until its face touches the barrel; by these means the staples are made to project with the same height all over the barrel. It is also necessary that the staples should stand perfectly straight or plumb, after they are driven into the barrel; otherwise, the slides E would not strike fairly upon their centres, so that the pattern would be incorrect upon the cloth; but, to avoid this evil, a small piece of sheet iron, of about $\frac{1}{8}$ of an inch thick, is hollowed out at one of its edges, to fit exactly the circumference of the barrel A, as shown at P^1, Fig. 87, and the opposite edge is left straight, as at Q^1, the ends being perpendicular to it, as at R^1 R^1. When the stapler has driven a staple into the barrel, as aforesaid, he brings the guage iron, Fig. 87, against it until one of the ends R^1 R^1 comes in contact with it, and if the staple be crooked or inclined to one side, he uses the small hammer or mallet 70 in his right hand, to strike it to its proper position, holding the guage iron in his left;* he then turns the guage iron, by bringing its edge Q^1 in contact with the barrel

* Perhaps it is necessary for the reader to bear in mind, that in all our descriptions of machinery and apparatus given in this Work, we make no allowance whatever for that portion of the human family (male or female) who are so unfortunate as to have the most essential (in weaving) members of their bodies misplaced; as, for instance, a left hand for a right, a right foot for a left, &c.

longitudinally, and proceeds to straighten the staple on the other sides also, if necessary.

We shall now consider the mode or method of lifting the harness cords R R R R by their respective tail cords:—Each tail cord, as formerly stated, passes through one of the slides E, and after descending about 8 inches, a knot is made upon it, as at S^1, Fig. 85; it is then passed through a hole in the guide board T^1 about 8 inches from this knot, so that the whole distance from the slides E to the board T^1 is about 16 inches. The knots stand in a row, horizontally, and are $\frac{3}{16}$ of an inch or thereabout from each other. U^1 (see Figs. 85 and 91) is a wooden roller of about $4\frac{1}{2}$ inches in diameter, having suitable iron gudgeons driven into its ends, serving as an axis on which it turns round. On one end of this roller is affixed a throated pulley (like that marked U in Fig. 86,) in which a strong cord W^1 passing over three fourths of its circumference, is made fast. A small groove X^1 (see Fig. 91) is cut out of the roller U^1 lengthwise, of the dove-tail form, and into this groove the back of the comb which lifts the knot cords is inserted. This comb must be made of good smooth hardwood, and the teeth must be formed at such distances apart from each other, that each tail or knot cord shall stand directly opposite the interval between two teeth, without interfering with them. A side view of the form of these teeth is given at Y^1, Fig 91, and it may be observed, that they are turned similarly to a parrot's bill, but upwards, (whereas, the bill of that talkative little creature is generally turned downwards,) so that they may more effectually prevent the knot cords from dropping when the weaver is opening the shed. On the reverse side of the throated pulley is another cord Z^1 with a stop knot, and with a weight A^2; which weight recovers the comb roller U^1 to its proper position when the weaver lifts his foot from off the barrel treadle J^1. In Fig. 85, the comb roller U^1 is represented with the shed formed, and the dotted line shows the position of the knots S^1 when not lifted. The teeth of the comb or roller U^1 stand generally about $\frac{3}{4}$ of an inch under the knots S^1 when the loom is at rest, so that these knots may be thrown into them to form the pattern, as represented on the barrel A. The knot cords against whose slides the staples strike, are lifted, and the remainder, not being thrown into the teeth of the comb, are omitted, and thus they serve to form the ground of the fabric.

We shall now describe the manner in which the slides E are drawn away from the face of the barrel A, so as to allow the weight X^* to turn round the barrel half a tooth or interval to each

change of the pattern :—A small cord F is attached to each slide, as at B^2 B^2 Fig. 86, and the other end of this cord is made fast to a leather strap H; which strap is nailed to the roller G; and this roller has a throated pulley C^2 on one end; a cord D^2 works in the throat of this pulley in a similar way to that of the comb roller U^1 and it is connected to the treadle cord I^1 as shown in Fig 85. Now, it is evident, that if the barrel treadle J^1 be depressed, the roller G will draw the slides E away from the surface of the barrel A; but this must not be done until the comb roller U^1 has taken hold of those knots which were thrown into its teeth by the staples, and has lifted them a little above the other knots, which remain stationary; and, to effect this, the cord D^2 is longer than the cord W^1 which turns the comb roller U^1, and, therefore, does not begin to draw away the slides E from the barrel A, until the comb has been raised to this position: if the comb roller U^1 remained at rest until the slides E were drawn back, and then came into action, it would lift the whole of the harness, instead of a proper change of the pattern, because all the knot cords would be thrown into the teeth.

The tumbler cord of the pulley G^1, shown in Fig 88, is connected to the barrel treadle cord I^1 in the same way as those of the comb roller U^1 and slide roller G, and its length is such that it does not begin to operate upon either of the catches Y Y until the slides E have been drawn back from the barrel A; otherwise, although one of these catches were lifted, the weight X^* could not draw the barrel round, in consequence of the staples coming in contact with the points of the slides.

If we suppose, for example, the spur wheel B to contain 400 teeth in its whole circumference, it will give 800 different changes of pattern in the cloth. If the design is what is termed a *point* or *centre* pattern, which consists of two halves exactly alike, then, as soon as one half has been woven up to the last change of the barrel, the weaver shifts the weight X^* from its cord to that marked X, and puts the latter in the place of the former; when he again begins to work, he depresses the barrel treadle once without throwing in any weft, (to prevent a repetition of the last line or change of the pattern;) were this not done, the same line would be worked twice over, which would occasion a defect in the cloth, called a double point; he throws in weft for the next line of the barrel, which now turns in an opposite direction from what it formerly did, and continues the operation otherwise as before. Thus, it will be perceived, that a barrel with a spur wheel containing 400 teeth or intervals will

produce a pattern on the cloth of 1600 changes, allowing one pick of weft for each: but, for example, if 8 leaves of headles be used, as in damask weaving, (which see,) and as many treadles, then, the weaver may keep down his barrel treadle J', at each change of the pattern, while he works over (with his right foot) the 8 ground treadles, throwing in a pick of weft to each respectively; consequently, there would be 8 picks of weft, instead of one, as in the former case, for every change of the pattern on the barrel A; thus, 12800 threads of weft may be given with 8 leaves of headles for the ground, on a spur wheel of only 400 teeth.

The position of the ground treadles may be seen in Fig. 85, and they are numbered from 1 to 8; the front leaves of headles are not shown, but they are in all respects the same as those used in damask weaving (see Gilroy's damask power looms.)

The sides of the slide frame I I are $4\frac{1}{2}$ inches apart; the wire of which the slides are made is about No. 8, and the holes in them through which the tail cords pass, must be countersunk both above and below, and well polished, so that they may not cut the tail cords; the slide roller G, is generally about $2\frac{3}{16}$ inches in diameter, and should be made of well-seasoned wood.

We trust that from this description of the barrel machine, (which is the only one ever given to the public, of any practical utility, either in this country or in Europe,) our manufacturing friends will be fully enabled to understand its mechanism, and to construct it for themselves.

The apparatus represented in Figs. 88, 89 and 90, is of our own invention; we refer to the pellet F' the pulley $G,'$ the tumbler shaft E', with its arms D' D', catches Y Y, and the minor parts with which they are connected. This combination we have found from experience to be far superior to the endless screw or worm, used by Mr. Morton, for working the spur wheel B; because the screw is sometimes liable to give out more than one line of the pattern on the barrel A at once, and at other times it does not give out so much; in either of which cases, the pattern is injured. We think it superfluous to give any details regarding this screw contrivance of Mr. Morton's as it would only be wasting the reader's, and our own *valuable* time, on a subject of no practical utility to either weaver or manufacturer. E. K. Arphaxad, as appears from his Oration delivered before the Median monarch, King Deioces, seems to have been thoroughly acquainted with the barrel machine, as constructed by Mr. Morton. (See Introduction.)

JACQUARD MACHINE (FRENCH.)

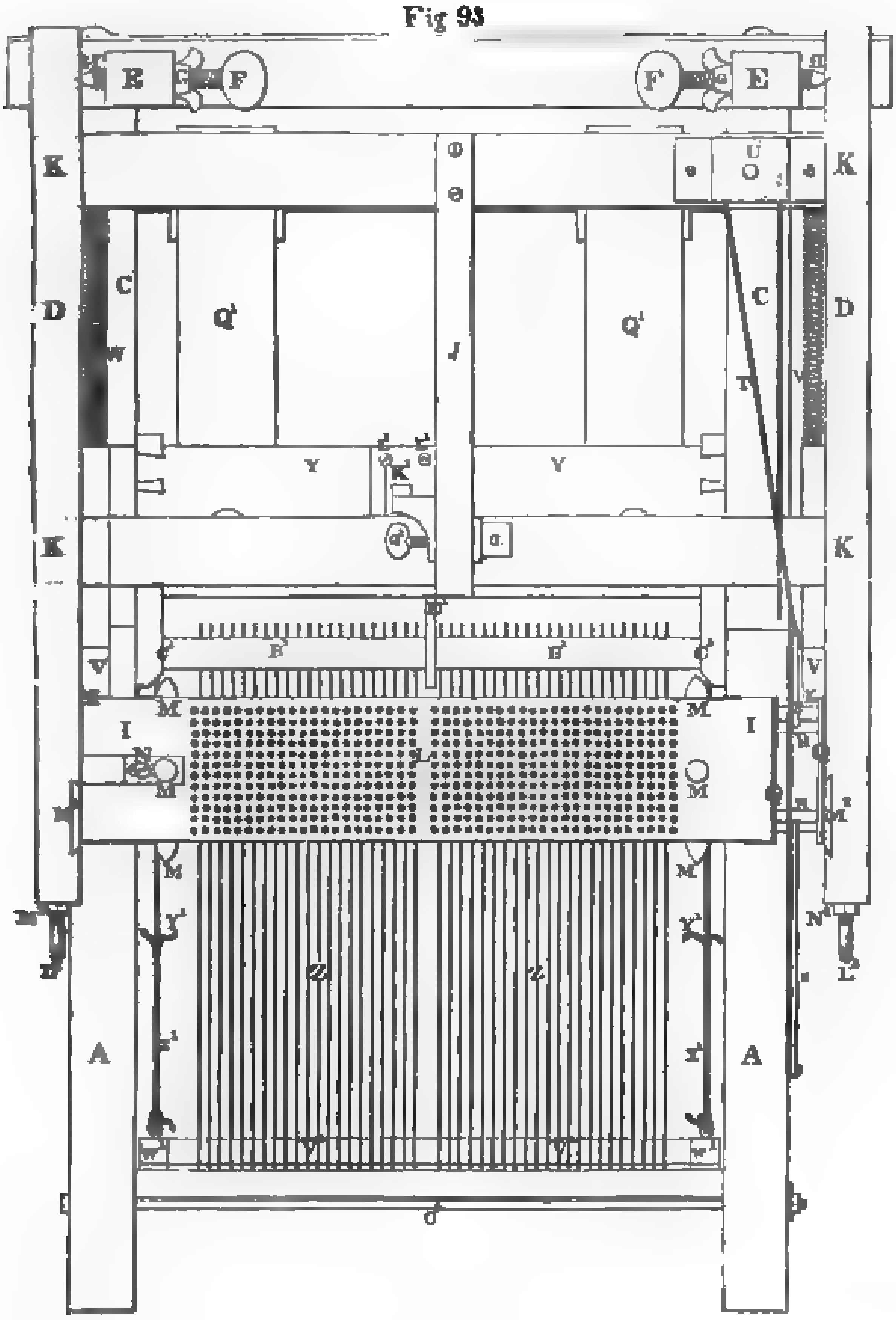
Shortly after the introduction of the barrel machine, from the East by Mr. Thomas Morton of Kilmarnock, another very ingenious apparatus, invented by M. Jacquard, a native of Lyons, was smuggled from France into England, by Mr. Stephen Wilson, silk manufacturer, (brother to Samuel Wilson, Esq. late Lord Mayor of London;) and its peculiar mechanism, no less than its acknowledged utility, renders it an object well worthy the attention of both weavers and manufacturers.

Like many other great inventions, the progress of this machine was not near so rapid as its merits might have led us to suppose, and this may be traced to two causes; the first of which was, the opposition of interested parties (weavers) who erroneously feared that they would be injured by its introduction among them; the second was, the imperfection of some of the movements of the machine itself, which its ingenious inventor appears to have been unable to obviate. Although M. Jacquard justly deserves the honour of having first constructed a machine with which the pattern was produced by means of pierced cards or pasteboard strips working against parallel rows of needles, still, the general perfection of such a contrivance, as now in use, must be ascribed to other scientific and practical weavers, both in Europe and America; among whom we would mention the following:—In France, M. Dioudonnat and M. Bosquillon, Paris; in England, Stephen Wilson, Esq. and John Dove (foreman to Messrs. Lee and Edward Wilson, silk manufacturers, 124 Wood Street, Cheapside) London; in Scotland, Claude Wilson, James Morrison, H. and J. Crawford, Paisley, and Thomas Morton, Kilmarnock; in America, Ichabod Hook, Lowell, Mass.

But to proceed to our subject, a loom mounted with this machine has neither tail, simple, nor lashes; and the pattern is cut out on pieces of pasteboard, (or sheet tin,) which are connected together, so as to form an endless chain, as represented in Fig. 97. The harness is constructed very similarly to "Cross's counterpoise harness." Fig. 93, is a front elevation of the Jacquard machine, as it appears when at rest, showing the cylinder, pierced with holes, for carrying round the endless chain of pattern cards; Fig. 94 is an end view, or that part which presents itself to the weaver when seated on his loom; and Fig. 95 is a vertical section, taken transversely through the machine, showing the back board or wire guage for supporting the ends of the needles and keeping them in their proper places; it

also shows the two leather straps and their pulleys for lifting the griff frame.

Fig 93



We would here remark, that in describing the drawings just alluded to, the same letters of reference indicate similar parts in all of them. A A, Fig. 95, is the frame of the machine, connected by suitable cross bars at B B B B; the two upright posts C C, one at

each end of the machine, support the cylinder frame D D, being firmly held in their places by two cross pieces or bars E E, one of which cross pieces is very visible in Fig. 94, and the ends of both

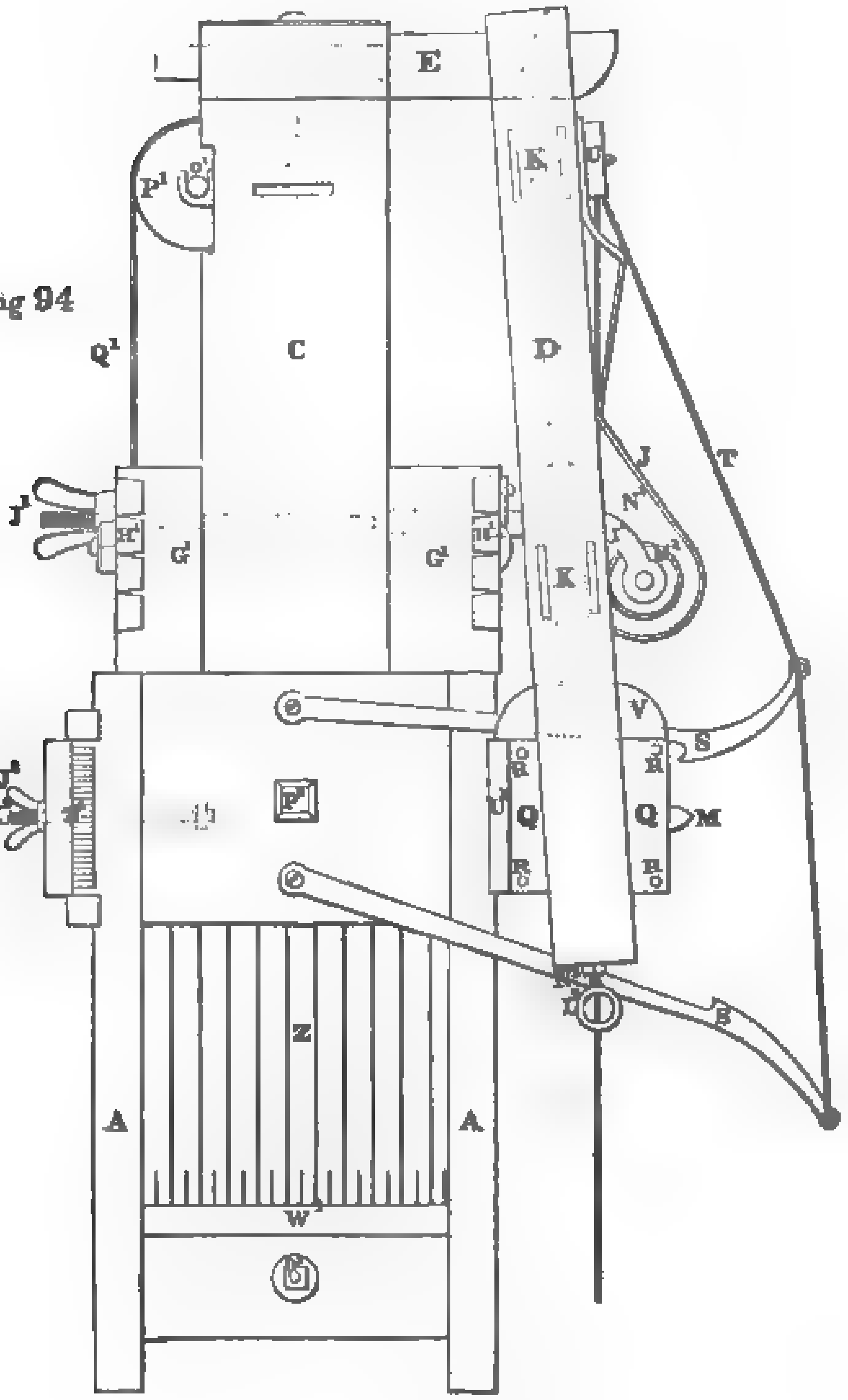


Fig 94

are shown in Fig. 93: into these are inserted the pointed screws F F, which are fastened by means of the thumb screws G G; these being brought against the cross pieces E E after the screw points

H H have been inserted into small brass or steel bushes on the sides of the cylinder frame D D; in which bushes these screw points work; while, at the same time, the frame D D vibrates or swings upon them: this frame is adjusted by the screws F F, so that the cylinder I I may be brought fairly against the needles, or horizontal wires, that are to play into the holes on its sides or faces. A complete row of these needles, on an enlarged scale, as seen from the side of the machine, numbered at their points from 1 to 8, is represented in Fig. 96. J is a bent piece of iron, seen in front of the machine Fig. 93; and a side view of it is given in Fig. 94: this iron piece is screwed to the middle of the two cross bars which connect the sides of the cylinder frame D D, and these bars are mortised, as shown at K K Fig. 94. The cylinder I I is merely a square axis; it is movable upon two iron pivots, driven into its ends, and it occupies the lower part of the frame D D. The four sides or faces of the cylinder are pierced with holes of from $\frac{1}{8}$th to $\frac{1}{4}$th of an inch in diameter. It is the general custom to have 2 spare rows of needles, in depth, one on each side of the centre, and these are used for working the selvages, independently of those which work the pattern. In a machine, for example, containing 400 needles for the pattern, there are 8 holes in breadth and 52 in length, on each side of the cylinder, as represented in Fig. 96: one row is left blank, as at L Figs. 93 and 95. A Jacquard containing 600 pattern needles will have 12 holes in the breadth of the cylinder, and 50 in length, besides 2 rows for the selvages, as in the former example. The cylinder I I has 8 knobs M, four at each end, and 6 of these may be seen in Fig. 93: those on the right hand end are made of box-wood, and the left hand ones of brass; the latter are riveted into small pieces of iron, which are fastened to the cylinder by the screws N, and one of these screws is shown in Fig. 93. The knobs are so arranged, that the holes O O O O O O of the pattern cards, Fig. 97, shall fit them loosely, in order that each card, when brought upon that side of the cylinder which is next to present itself to the needles, may lie perfectly flat or level against it: the screws N serve as regulators or adjusters for this purpose. In the successive application of the cards P P P (see Fig. 97) to each side of the cylinder, the holes O O in each card must always fall directly opposite to those pierced in the other cards throughout the whole series which compose the pattern, so that the knobs M may carry them round in regular succession during the operation of weaving. Near the right hand end of the cylinder, and square with it, there are two square plates of sheet iron Q Q (see Figs. 93 and 94,) each about $\frac{1}{8}$th of an inch

thick, with a distance between them of from 1 ¼th to 1½ inches; they are parallel to each other, and are kept in their places by the square part of the gudgeon of the cylinder which passes through their centres. Four small pins or studs R R R R connect these plates at their corners, as shown in Fig. 94, and two of them are represented in Fig. 93. A small roller is placed on each pin, to prevent them from being worn, and to diminish the friction of the catches S S, which turn the cylinder round upon its axis. The catches S S are hung upon suitable centres inside of the frame, and either of them may be brought into action by means of the cord T; which cord passes over a pulley U at the upper part of the machine (see Fig. 93,) and thence descends to a convenient place for the weaver's hand, where a knot is made upon it, to be passed, when required, into a saw cut or notch, like those in the trap boards of Cross's machine, Fig. 72: below the knot, there is a small wooden bob attached to the cord, on which the weaver lays hold when he finds it necessary to bring the under catch S into action, and slips the knot into the saw cut, as before described. When this is done the cylinder I I turns round backward, or in a contrary direction from what it formerly did; and this is often the case in point patterns, in which one half of the figure is exactly the same as the other half: in such a case, the weaver, by working regularly over his cards up to the last one, and then reversing the action of his cylinder, saves half the cards that would be required were he to continue turning the cylinder one way until the pattern was completed.

When the weaver requires to unravel part of the cloth which he has just woven, in consequence of some defect, such as is produced either by the breaking of warp or weft threads, or by using a wrong colour, (which very often happens where forty or fifty are necessary to form the pattern,*) he brings the under catch S into play against the cylinder head, for the purpose of making the chain of cards move backward, in order to find the particular card by which the pick of weft nearest the reed was thrown in; and, again form-

* Thirty colours (and as many shuttles) were used in the manufacture of her Majesty, Queen Victoria's coronation dress; and 276 were employed in the production of Pope Boniface's night shirt; in the latter of which fancy articles, these colours were so arranged and blended together, as to display correct likenesses of 276 heretics, each suffering under some species of torture different from any of the others; and thus the night shirt of his Holiness contained not only a greater variety of colouring, but also more terrible specimens of *design* than any shirt, perhaps ever manufactured in Europe.

ing the shed by it, he withdraws the pick; and thus he proceeds until the defective part of the cloth is entirely unraveled.

V V are two pieces of wood, each shaped like a rake (without teeth,) and its stem or shank passes up through the cross bars of the frame D D: the under one of these bars has a square hole in it at each end, to prevent the pieces V V, which are also square where they pass into these holes, from turning round; those parts of these pieces which pass through the upper cross bar are round, and have spiral springs W W coiled loosely about them; the upper end of these springs bear against the under side of the top cross bar of the frame D D, so as to press the pieces V V downward against the pins R R R R in the cylinder head, two of these pins coming under them every time the cylinder is brought into contact with the needles, so that the springs W W, by pressing down upon the shoulders of the pieces V V at X X, keep the cylinder I I perfectly on a range with the needles which play into it. It is evident that while the cylinder is being turned round for the purpose of presenting a new card of the pattern to the needles, the springs W W will give way or be compressed, so as to allow the cylinder to turn past its centre; and when this is accomplished, the cross pieces V V, by means of the springs W W, will immediately recover their former position, and at the same time bring the cylinder I I on a range with the needles; and all this takes place during the outward motion of the frame D D, one of the catches S then operating upon the cylinder head.

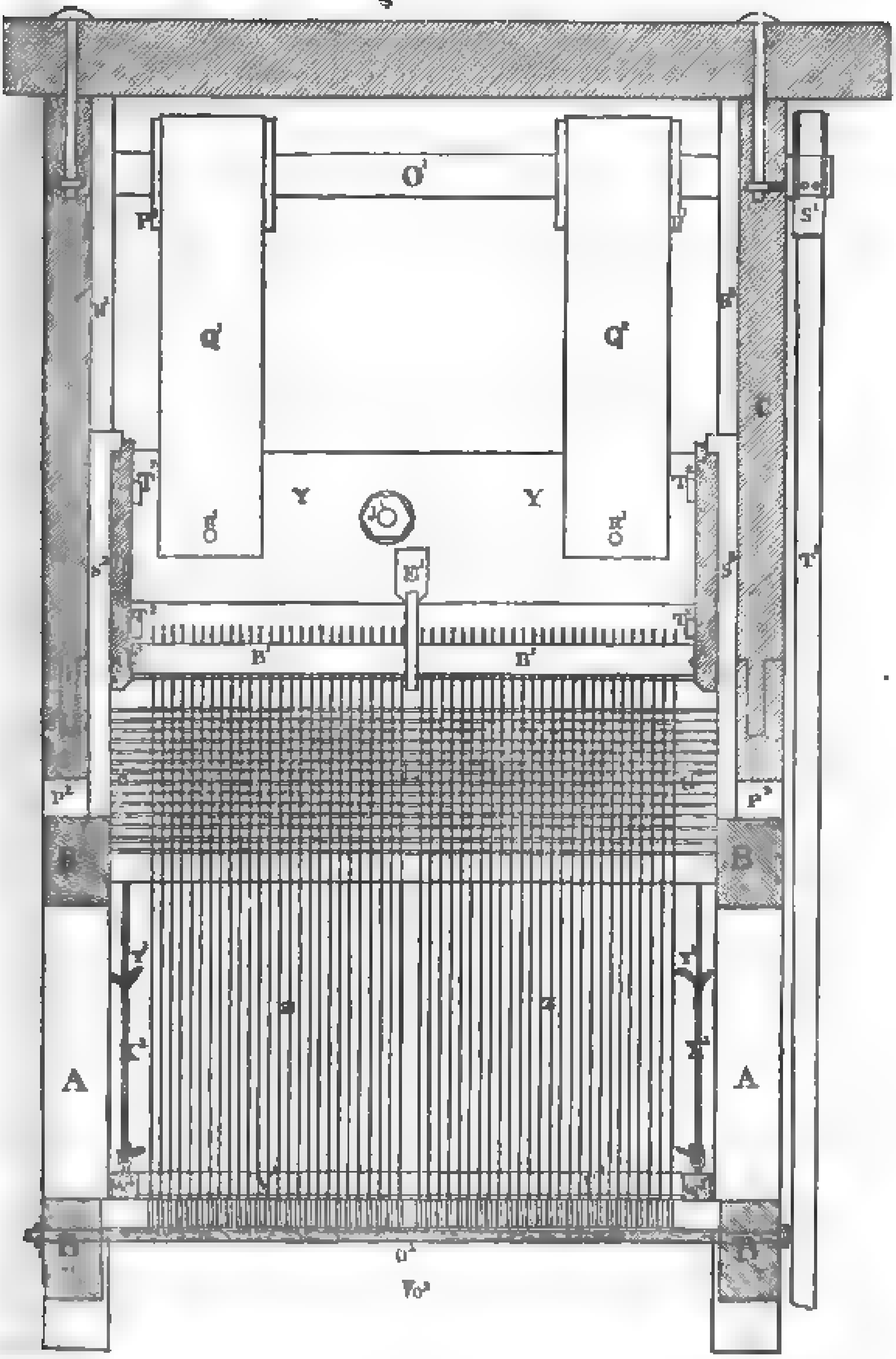
Y Y is the griff frame for elevating the perpendicular wires Z Z, by their hooks at the top: to the lower ends of these wires the harness is connected, as at A^1 A^1, Fig. 96. The griff frame contains one straight-edged piece of iron B^1 for each row of hooks in the machine, and these pieces are inserted into the ends of the frame, as at C^1 C^1, Figs. 93 and 95. A side view of one row of hooks is given at D^1 D^1 Fig. 96, and their straight-edged lifters B^1 B^1 B^1 in the same Fig. are shown in perspective. The centre piece E^1 helps to support the lifters, through each of which a suitable mortise is cut to fit tightly into it; and the end pieces G^1 G^1 connect the sides of the frame Y Y by being dove tailed into them, as shown at H^1 H^1 Fig. 94. A bent piece of iron I^1, adjusted at its back end by a nut and screw J^1, passes through the centre of the back cross bar Y, and its other end, which is square, passes through a square hole in the front cross bar Y; and to prevent these bars from being worn, a small iron plate K^1 is fastened upon each by the screws L^1 L^1, which may be seen in Fig. 93. The piece of iron I^1, after hav-

ing passed through the said square holes, is bent to the right hand side, for the purpose of receiving the friction roller M', which works in the curvilinear space N', of the curved iron J: a side view of these parts is given in Fig. 94.

The lifting of the griff frame is accomplished by the following means:—There is a shaft O' O', running across the frame of the machine, and resting on suitable bearings at each end, on which it turns; and on this shaft there are made fast two wooden pulleys P' P', to each of which is attached a leather strap Q' Q', and this takes a turn round three fourths of the pulley: the other ends of these straps have holes R' R' in them, through which two iron spindles pass, and these spindles are kept in their places by means of heads which are made upon them at one end and screw nuts at the other. The proper position of the straps Q' Q', is in the centre between the cross pieces Y Y; and the pulleys P' P' should be of sufficient diameter to permit the straps to hang in the centre of the griff frame, so that this frame may be lifted with as little friction as possible in the operation of weaving. On the right hand end of the shaft O' O', and outside of the frame, is affixed a pulley S' with a strong strap or band T' nailed to it, and taking a turn round three-fourths of its circumference, in an opposite direction to the straps Q' Q' thence down to a treadle, to which it is connected. When the weaver depresses this treadle, the strap T', by means of the pulley S', causes the shaft O' O', with the pulleys P' P' and straps Q' Q', to lift the griff frame Y Y, and with it those perpendicular wires whose needles are entered into the holes of the pattern cards and cylinder, according to the figure to be produced in the cloth; and while the griff frame is rising, the friction roller M', being affixed to the end of the bent iron I', throws out the cylinder frame D D gradually, by working in the curvilinear space N', of the iron J, and brings one of the catches S in contract with one of the pins R on the cylinder head: the griff frame continuing to ascend, by means of the friction roller M' working against the inclined part of the iron J, causes the cylinder to turn round another side, bringing with it a new card of the pattern; and, when the weaver lifts his foot from off the cylinder treadle, the griff frame descends, leaving the lifters B' B' in the position shown in Fig. 96; which Fig., as before stated, represents one complete row of needles, numbered at their points which pass through the front board U', against which the cylinder strikes, (see Fig. 94.) It will now be perceived, that by working the strap or band T' (see Fig. 95) in the manner

ist stated, the cylinder I I will be turned round upon its axis, as to bring a new card against the needles every time the eaver depresses his treadle; and thus the cards of the endless hain are brought into action in regular succession, one after nother.

Fig. 95



The wires Z Z are turned up at their lower ends, as represented in Figs. 94 and 96, and into the loops thus formed small rods or slips of wood V^1 V^1 are inserted, from side to side of the machine, one rod passing through each row of needles, and the ends of these rods at one side of the machine, are dove-tailed into a cross piece W^1 (see Figs. 93 and 95) which prevents them from turning; their ends at the other side are round, and are inserted into another cross piece W^1, where they are fastened by small nails or brads: the rods fit loosely in the needles. Four small cords X^1 X^1 connect the frame W^1 W^1, to the under side of the griff frame, as shown in the Figs.; and they are adjusted by the slip knots Y^1 Y^1. The use of the frame W^1 W^1 and the rods V^1 V^1, is, to prevent the hooks D^1 from turning round, or from being thrown out of their proper position during the operation of the loom. The loops or turned up part of the wires Z, through which the rods V^1 V^1 pass, are usually one inch longer than the intended depth of the shed in the warp: were this precaution not used, these rods would be lifted out of the loops when the griff frame was raised, so that the hooks D^1 would have nothing to prevent them from turning round; and should any of them get out of their proper place, the rods V^1 V^1 could not recover their former position on the descent of the griff frame. In the French machine, from which we made these drawings, while at Lyons, the loops or turned up part of the wires Z were 4½ inches long, and the shed in the warp was 3½ inches deep: these proportions work very well.

The perpendicular wires Z Z should be made of No. 12 wire, and the needles of No. 14; both of which must be sufficiently tough to stand the process of bending and also stiff enough not to give way in the operation of weaving. Z^1 Z^1 is a wooden box, called the spring box (see Figs. 94 and 96,) which is pierced with as many holes as there are needles in the machine, and into each of these holes, a small brass spiral spring A^2 A^2 is inserted (see Fig. 96;) which springs are generally 1⅝ inches in length, and nearly $\frac{3}{16}$ths of an inch in diameter, and they are made of No. 28 wire (which should be very elastic.) Each of these springs bears against the back end of a needle, as at B^2 B^2 Fig. 96 and at C^2 Fig. 98: the needle represented in Fig. 98, corresponds to that marked No. 1 in Fig. 96.*

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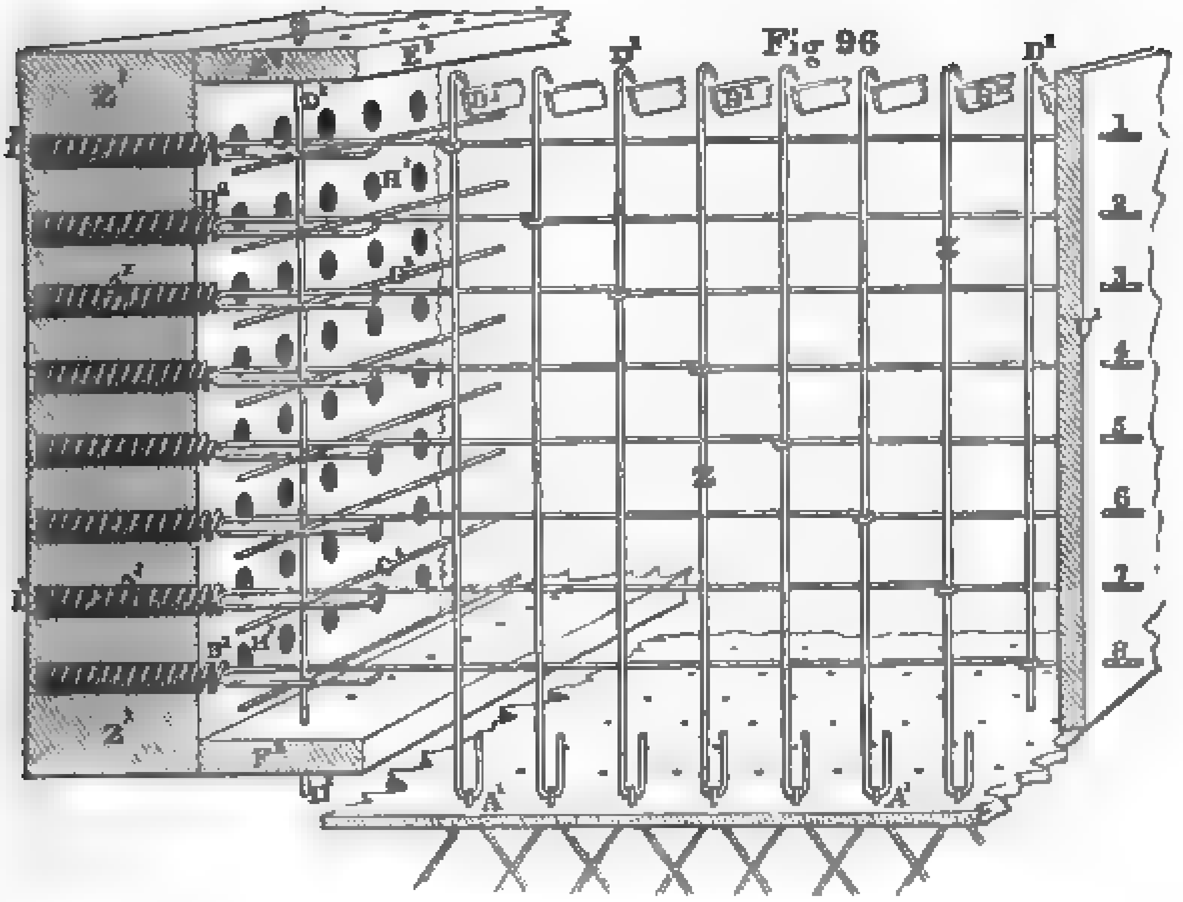
* It is not perhaps generally known, that M. Jacquard did not employ perpendicular wires like those marked D^1 D^1 in Fig. 96, in the first machines which he constructed, but knot cords and trap boards like those shown at Figs. 71 and 72.

Fig 96



Each row of needles, in depth, has a wire pin D^2 D^2 passed through it at the back ends of the needles, and the ends of these pins are inserted into the cross rail E^2 above the needles, and into the cross rail F^2 below them; which pins serve to keep the needles in their proper position, as shown in Fig. 96. The rails E^2 and F^2 are drawn in perspective, and the black dots indicate the position of the perpendicular wires D^2 D^2, as well as the distance between the rows of needles. G^2 G^2 (see Figs. 95 and 96) are the cross wires which support the needles. The holes H^2 H^2 show the position of the springs A^2 as they stand in the box Z^1 Z^1: it must be observed, that this view is in perspective. The spring box Z^1 Z^1 is bored to within about about $\frac{1}{4}$ of an inch from its bottom, as at I^2 I^2 Fig. 96. We may here remark, that we ourself, have superseded the necessity of using the spring box altogether, and also made several other improvements upon the Jacquard machine, particularly in a new method of governing the griff frame, by which a saving of power to the amount of 50 per cent is effected: these improvements, with many others which belong to us, are fully described under the head of "Gilroy's patents" (see Index.) But, to proceed, the needles pass through what is called the needle board U^1 U^1, against which the cylinder I I plays: this board is about $\frac{3}{4}$ths of an inch thick, and the points of the needles which are actuated by the cards project beyond it about $\frac{1}{8}$ths of an inch.

It is now evident, that those needles which are pressed back by the blank or uncut parts of the card (represented in Fig. 97,)

Fig 97.

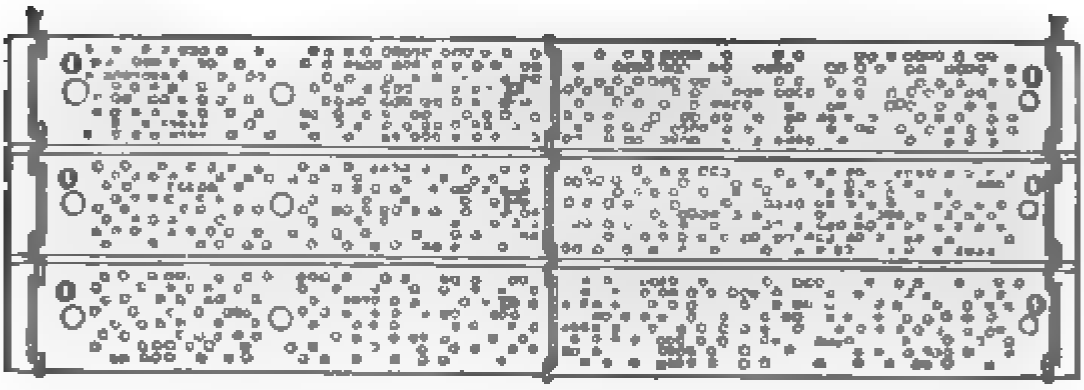


Fig. 98

when the cylinder is brought against the needle board U^1 U^1, will throw back the wires Z Z which pass through them, so that when the weaver elevates the griff frame, the hooks D^1 of these wires will be missed by the lifters B^1 B^1 B^1, and all the others will be raised, (see Fig. 96.) Each card represents one line of the design paper, and by all the cards being worked over in regular succession one after another the pattern is formed upon the cloth.

It is sometimes of advantage, particularly when the pattern is heavy, to miss the hooks connected with those needles which enter the holes of the cards, and lift the others. To effect this, when the cards have been cut in the usual way, the position of the lifters B^1 B^1 B^1 must be reversed, so as to incline in an opposite direction, and the hooks D^1 must also be reversed or turned round: the weaver may work on otherwise as before, and there will be no difference in his cloth, except that the pattern will appear on the under side of it, instead of on the upper side.

The thumb screws J^2 and bolts K^2, at each side of the machine, serve to keep the spring box Z^1 Z^1 in its proper place at the ends of the needles, as seen in Figs. 94 and 96. The screws L^2 L^2 (see Figs. 93 and 94) are used in adjusting the cylinder, so as to answer the points of the needles; they push against the under side of small brass bearings, in which the pivots or gudgeons of the cylinder work: these bearings are let into the wood of the cylinder frame D D, and are kept from dropping out by small pieces of wood M^2 M^2, which are dove-tailed into the sides of the cylinder frame, as seen in Fig. 93. The screws L^2 L^2, when the cylinder has been adjusted by them, are secured from turning round by means of the nuts N^2

N^2, which are brought to bear tightly against the under ends of the frame D D (See Figs. 93 and 94.) O^2 is a bar to support the middle of the neck board; P^2 P^2 are pieces of leather to ease the griff frame in its descent (see Fig 94;) R^2 R^2 are brass slides in the sides of the upright pieces C C, into which the square rods S^2 S^2 are screwed to the ends of the griff frame, with the screws T^2 T^2 T^2 T^2. (See Fig. 95.)

Lastly, we would observe, that in patterns which require one pick of weft only to a point, one card also will be required for each pick: thus, for a pattern of 5000 picks, there must be 5000 cards likewise: but in fabrics where leaves of headles are used to produce the ground, from 2 to 16 picks of weft are usually given to each card or change of the pattern. In shawl weaving, when two colours of weft are employed, two picks of weft are given for each card, one for the ground and the other for the figure; and when a greater number of colours are used, there must be distinct cards for each. In damask weaving, it is customary to use 8 leaves of headles for the ground, the weaver throwing in either 4 or 8 picks of weft for each card regularly; and if only 4 are thrown in for one card, then, the 4 treadles used in working it must not be used in working the succeeding card, but the other 4 treadles must be employed; otherwise, the tweel would be broken. It matters not, whether the weaver changes his cards to every 4 or 8 picks so long as he continues to work his treadles in regular succession. For weaving full satin, 16 leaves of headles and as many treadles are necessary; but the weaver may produce either an 8 or a 16 thread point, by working over the half or the whole of his treadles to each card.

A patent was granted in America, bearing date February 3d, 1841, to Alexander Calderhead, of the city of Philadelphia, Pa., for placing the cylinder, cards &c., of the Jacquard machine, underneath the warp, and substituting a series of perpendicular wires or needles, arranged in the harness board in parallel rows, each needle representing one of the twines or sleepers of the harness; and these alterations the patentee calls, "an improvement upon the French machine," as described by us, and shown at Figs. 93 to 98. He commences the description of his apparatus in the following strain:

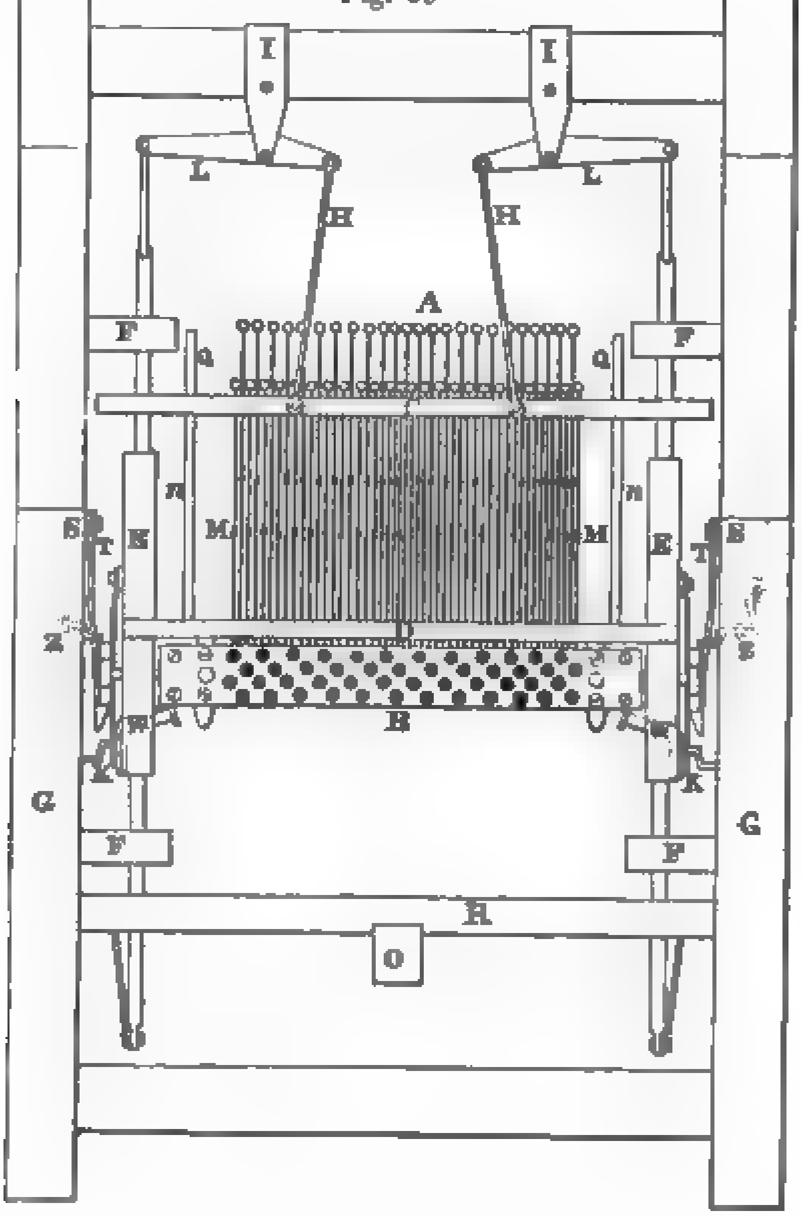
"I, Alexander Calderhead, have *invented* (it will be seen in the sequel that Mr. C. is not the inventor of this contrivance) a new, easy, and cheap method of weaving *all kinds* of figured cloth." This method consists, first, in raising and lowering the threads of the warp with what he calls "independent metallic headles," instead of the weights, mails, twines, &c. composing the mounting

of the draw loom ; and, secondly, "in constructing the cylinder a
pattern cards or apron, so as to lift directly the said headles or wir
to form the sheed or shire ;* or, in constructing a trunk and patte
web, both, to direct what shall be the sheed, by trapping or untra
ping the hooks or knot cords to be drawn up, as in Jacquard a
draw looms."

Mr. C. uses several terms here which we do not recollect of ha
ing seen applied before to anything in the way of weaving ; *tru*
for cylinder, *sheed* or *shire* for shed, heylds for headles, *foot boa*
for treadle, and *apron* or *pattern web* for pattern cards or chain
cards, must be new to most weavers, and, perhaps, these terms fo
the principal part of the invention.

"I (A. C.) make the heylds or perpendicular wires, for a Scot
imperial three-ply carpet, of No. 13 wire, the length of which heyl
is 24 inches. A head A (see Fig. 99)

Fig. 99



* For the meaning of the word *shire*, (in weaving,) see Plain Section First, of this Work.

is made on each of the said wires; and 14 inches below this head the wire is flattened, as at M M, where an eye is punched or bored in it, and these eyes are substituted for mails. The wires or heylds, work in two boards C and D (Fig. 99;) the board C suspends or hangs them, *by their heads* A; the board D serves as a guide to direct the point of each needle respectively throughout the series or range of the web into the holes of the trunk B, on which the apron or pattern web works. I (A. C.) make the boards C and D one inch thick, (each we suppose,) 5½ inches broad, and 4 feet in length, or long enough to work on the slides E E, (Fig. 99.) I (A. C.) bore the holes in the said boards C and D large enough to admit wires about 2 numbers coarser than that actually used, say for No. 11; and the holes of the trunk and pattern apron, I make ¼ of an inch in diameter, (we suppose that in making the holes of this size, allowance is given for atmospheric variations.) Each row in breadth of the boards C and D contains twelve holes; and all these rows are slanted (see Fig. 66, draw loom,) so that the back hole of one row shall be nearly square with the front one of another row: this prevents the warp threads from crowding each other. The trunk B, pattern web, and boards must be of the breadth of the web (curious jargon this!); and the trunk B is hollowed out the depth of the sheed. The trunk may be cast, or made of sheet brass, brazed together, and fixed or screwed on blocks or end pieces; and it turns on an axle or centre, which passes through the slides E E: these slides are 60 inches long, 25 above and 35 below from the point where the axle or centre of the trunk B passes through them. The slides E E are kept in their proper positions by the brackets or guides F F, and they are connected by suitable straps to *beams** L L; these beams are supported at the top framing of the loom by the hangers I I, and to their ends 4 rods H H are suspended. (Only two of these can be seen in the Figs.) The rods H H are connected to the board C (as shown in Fig 99,) two at the front and two at the back, for the purpose of raising and depressing the board C when required. *n*, *n*, are metallic rods, which pass through the board C, and are screwed or otherwise secured to the board D: the ends Q Q of these rods guide the board D, and keep it in its proper place. The under extremities of the slides E E are attached to the ends of the lever or cross bar R, (which may also be seen at B^2 Fig. 100:) on the ends or axis of the trunk B is a 4 toothed wheel P (see Fig. 101,) for the purpose of turning the trunk B, which is

* Jacks, not beams.

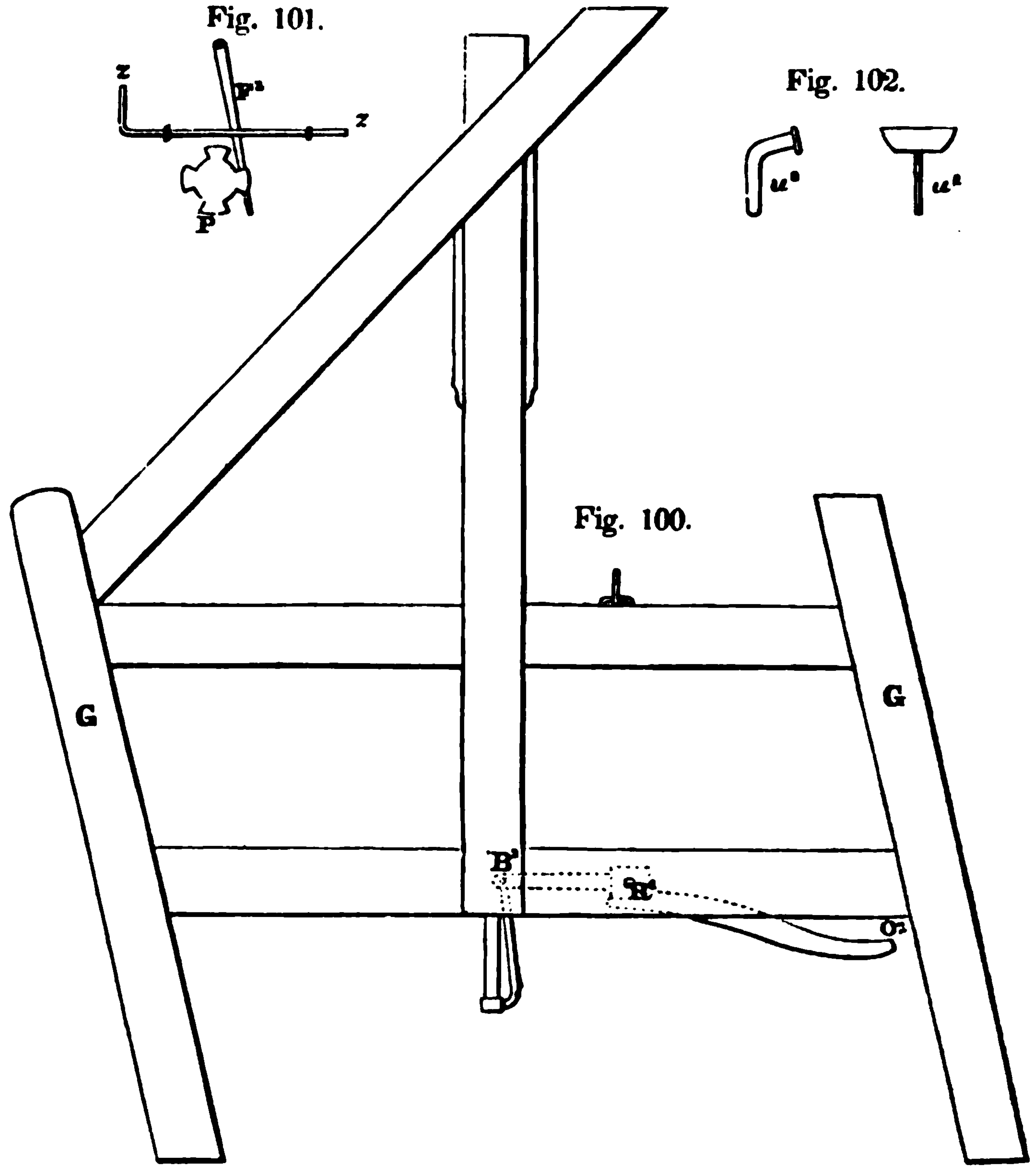


Fig. 101. Fig. 102. Fig. 100.

caught in its descent by the hooks T T (see Fig. 99,) attached to the frame of the loom at S S.

W W are levers, which work in the slides E E, and are pressed by springs K K, in order to bring and keep the trunk square (as is well understood, of course, being so like the apparatus used for a similar purpose in common Jacquards) the levers W W are more clearly shown at u^2, u^2, (Fig. 102.) Z Z (Fig. 99) are two slides, one at each side of the machine, which pass the hooks T T from one side of the toothed wheels P to the other, so as to make the trunk B revolve, either backward or forward (a view of one of these levers Z will be had in Fig. 101.) The operation of the machine is as follows:—"

"The foot board or treadle O (see Fig. 99) of the lever or bar R, by being pressed down with the foot, raises up the slides E E, the trunk B, and the guide board D, and lowers the rest board C: this allows the heylds or wires to pass into the trunk B wherever holes are cut or punched out on the pattern card or cards." (Every alter-

re is represented in Fig. 99, as being raised, and this would he warp threads passing through their eyes M M to be raised nd if these wires were raised and depressed alternately with ers, plain cloth might be produced.) "When the weaver foot from off the foot board or treadle O, the wheels P P g. 101,) on the axis of the trunk B, are caught by the hooks nd these hooks cause the trunk to turn one-fourth part of a on." (One of the hooks T may be seen at F^2 Fig. 101, cylinder treadle O is distinctly shown at O^2 Fig. 100: in 0, R^2 indicates the position of the lever or bar R, and B^2 that lides E E, for raising and depressing the cylinder B.)

enlightened patentee, the said A. C., claims, "the exclusive make the above specified machine, to suit *all kinds* of d cloth." He also claims, "the *principle* of lifting the *sheed* (not county) with metallic *heylds*, directly by the pattern and *trunk* (not portmanteau) *roll* or *receiver*, *or by lower- heylds into the same, as described.*"

have quoted above, Mr. C's own words, in order that our may judge correctly of his *pretensions* as a weaver. If he norant of mechanics as he appears to be of the proper names lifferent parts of the common loom, we need not be astonished h he tells us, that a machine, such as that represented in 9, 100, 101, and 102, "will manufacture all kinds of flow- th."

patentee, Calderhead, speaks of making "a Scotch imperial y carpet" with his machine; but, let us see how he could lish this:—In the first place, suppose a carpet 36 inches in , and containing 1800 threads of warp from selvage to sel- in this case 1800 needles or headles would be required, and ern cards and cylinder B would require to be 36 inches each, h; suppose each of the holes in the cylinder B to be ¼ of an diameter, (as stated by the *intelligent* patentee;) and after the necessary allowance for the metal left uncut between s, perhaps 3 holes might be got on an inch; then, as there holes in the row across the cylinder B, there would be 36 one inch of the length of it, and likewise 36 needles on one ross the web; so that in the whole breadth of the web, (36 there could only be 1296 needles, and, of course, the same of threads, instead of 1800. But, some kinds of figured ontain from 400 to 650 threads of warp per inch; and it appens that a web has as many as 16,000, or 20,000 threads om selvage to selvage, so that on the above principle, 16,000

or 20,000 needles, and the same number of holes in the cylinder would be required in such a case: besides, a web of this kind is very frequently 80 or 120 inches broad, and would require from 16,000 to 20,000 cards to produce the pattern. We question the applicability of the "*heylds*, *trunk*" and "*apron*" to webs of this description, unless the needles could be made of wire, at least, as fine as No. 60 or 70; and, moreover, cards 80 or 120 inches long might be found somewhat difficult to manage, at least, this is our opinion. Before dismissing this subject we would mention, that one of the most extraordinary specimens of silk weaving, perhaps, ever executed, was exhibited at Mr. Morrison's late conversazione given to the members of the Institute of British Architects. It was a portrait of Jacquard, representing that extraordinary man in his workshop surrounded by his implements, and planning the construction of that beautiful machinery, which now, in its increased perfection, returns this testimony to the genius of its inventor. This work, worthily entitled "*Hommage á J. M. Jacquard*," was woven with such truth and delicacy as to resemble a fine line engraving: it was executed by Didier, Petit & Co. There were 1,000 threads in each square inch (French,) in both the warp and the weft; and 24,000 cards were used in the manufacture, each card large enough to receive 1,050 holes.

But, to conclude, we would state, for the information of our readers, that we, ourself, made a machine on the same principle as that claimed by Mr. Calderhead, as far back as Jan. 1833, (for manufacturing common ingrain carpeting;) and a patent for which was granted to Claude Marie Helaire Molinard, of Bury Street, St. Mary Axe, in the city of London, merchant, bearing date 9th April 1833; (see vol. 15, Conjoined Series, of the London Journal of Arts and Sciences, for the year 1840, pages 286 and 287,) so that Mr. C's patent is, in point of fact, null and void. We may also remark, that a friend of ours, in London, William Webb, Esq., of the firm of James Jacquier & Co., No. 1 Wood St., Spitalfields, showed us a machine, in the year 1836, differing in no respect from that constructed by Mr. C., and represented in Figs. 99, 100, 101, and 102; and, no doubt, Mr. Webb would be glad to furnish any number of them to order, to whom we would recommend those of our friends who want such articles to make application forthwith. Perhaps machines of this description might be found of advantage in the manufacture of horse-blankets. (See Arkite Ghiden Ghelen's loom, Fig. A. Introduction.)

The pattern cards P P P Fig. 97, are cut (in *small* establish-

ments) between two steel plates, like those represented in Figs. 103 and 104.

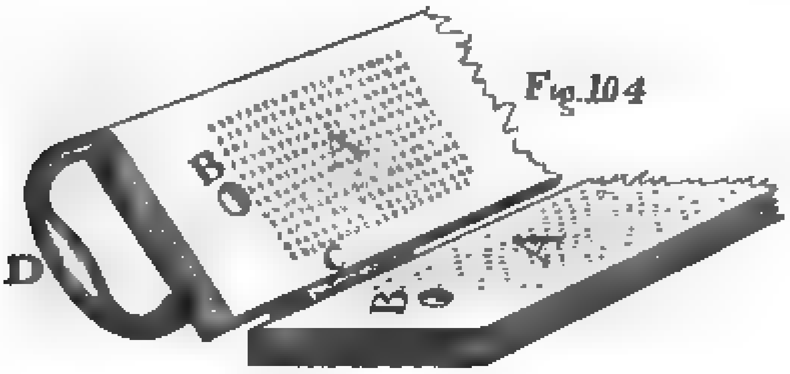


Fig. 104

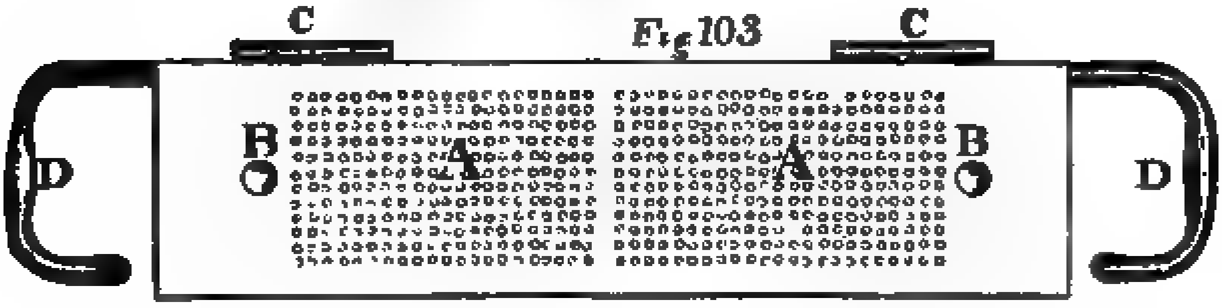


Fig. 103

The holes A A, in these plates, correspond to those of the cylinder shown in Figs. 93 or 99. B B (Figs. 103 and 104) are large holes to fit on the knobs M M in Figs. 93 and 94; C C are hinges which connect the plates, and they must be well fitted, so that the plates may present no impediment to the punching of the pasteboard or card paper, when it is placed between them; D D are handles attached to the upper plate, by which the operator raises or lowers it, when he wishes to take out or put in a card; the large holes B B correspond to those marked O O O Fig. 97.

The method of cutting cards in these plates, from the design paper or pattern, is so well known to all persons having the least knowledge of figured weaving, that we need give no further description of it in this place. We would state, however, that on this plan, an active man can only cut from 100 to 150 cards per day; whereas, on the great French card-cutting apparatus or machine, (to which the reader is referred,) he can cut from 2500 to 3000, with the assistance of a boy, in the same time.*

* We would here mention for the benefit of the manufacturers of this country, that a card-cutting machine of this kind, in its most perfect state, may be purchased from our friend, M. Dioudonnat, No. 12 Rue St. Maur, Paris, for 2400 francs; this includes the copying and stamping machines, the simples and all the other necessary apparatus, as well as the packing or boxing of the whole and its carriage to Havre for shipment. One of these splendid machines would, at least, be sufficient to cut cards for a manufactory containing 300 looms.

SECTION SEVENTH.

CARPETING.

The progress of almost any of the arts may be safely taken as an index of civilization. The arts, indeed, are so intimately interwoven, that one of them can scarcely flourish without giving rise to and receiving support from others. This is particularly the case in regard to the manufacture of carpets; which, like the other branches of weaving, has received improvements at every hand, and has lately made important advances. The very fact of the existence of such a manufacture speaks volumes as to the increase of our domestic comforts.

In the superficial texture of the common carpet, nothing appears to distinguish it from an ordinary web; and a first observer is at a loss to imagine by what means its variety of colours can be produced. On examining the figure more narrowly, it appears that the designer has laboured under considerable difficulties: for in many places where purity of colour would have been advantageous, a mixed colour, of the warp and weft, only is to be found, while scarcely any gradual shading of the tints depending on the nature of the figure is to be seen. A still closer examination explains at once the source of these imperfections. The ingrain or double carpet is found to consist of two contiguous webs, intermingled with each other in such a manner as to produce the pattern: each of these webs, if woven singly, would have a striped appearance, being partly coloured in the weft. One set of coloured stripes is thus imposed upon another: and in designing the colours of the pattern, no selection beyond what is afforded by the judicious arrangement of these stripes can be made. The number of full colours is thus very limited; and these can only be obtained when the weft traverses warp of the same colour. To bring up then part of the figure full red, red warp must be traversed by red weft these colours can be immediately concealed by sending the threads to the other web, but were they to remain long there, both webs would become monotonous. It is therefore extremely difficult to avoid a strong tendency to striping in the colours, and, except in the principal part of the figure, the colours can hardly be well managed, the secondary embellishments being almost matters of chance.

Yet, in the face of all these difficulties, patterns of great beauty are being continually formed on the carpet loom.

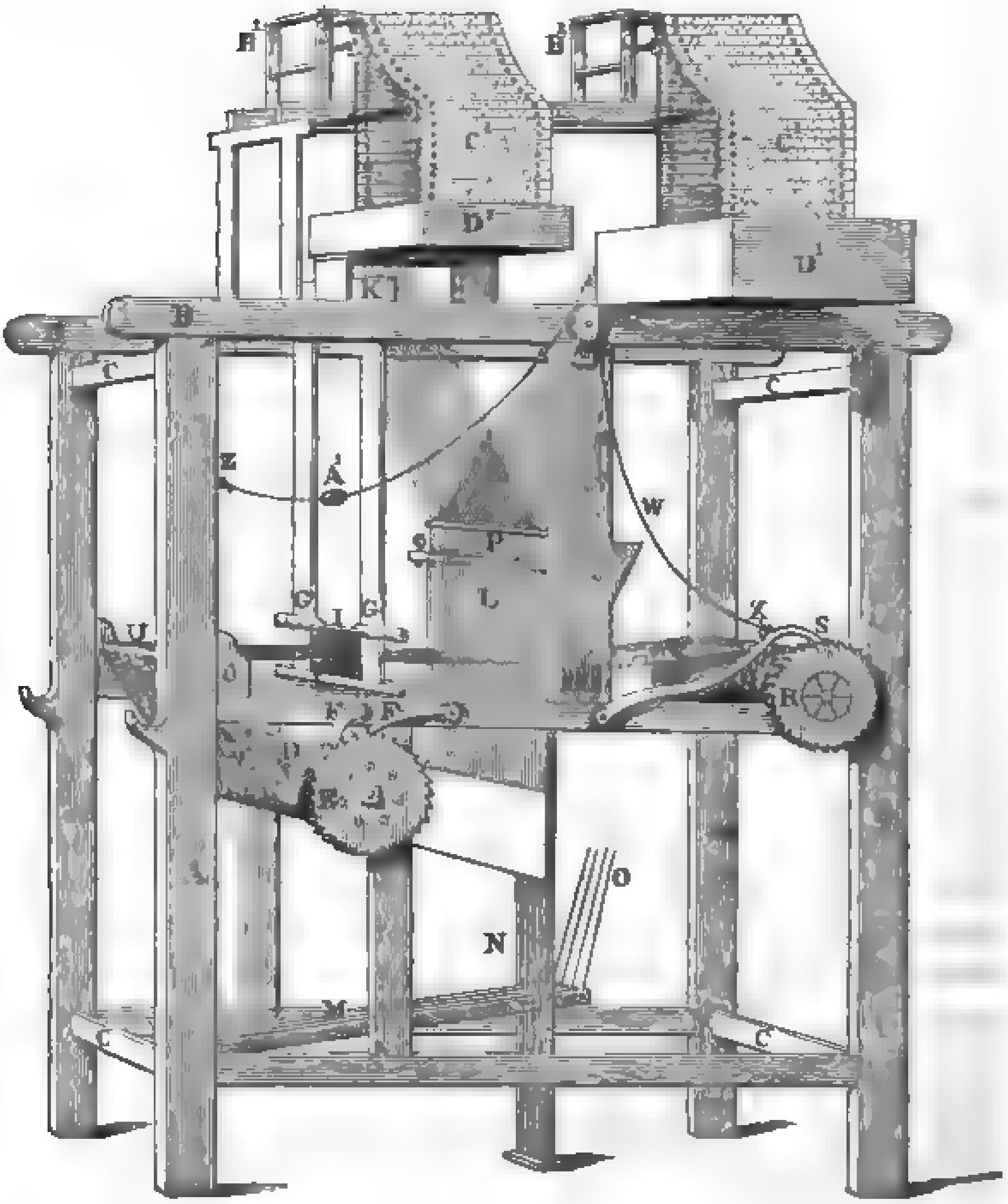
The invention of the *triple carpet*, *claimed* by Mr. Morton, of Kilmarnock, has almost removed these difficulties.* This carpet is composed of three webs, which interchange their threads in order to produce the pattern. The primary object in the introduction of the third web, appears to have been the obtaining of greater variety and brilliancy of colouring; but another curious effect has followed, that the two sides of the carpet are necessarily counterparts to each other. To a certain extent the figure of the under must depend on that of the upper side, since threads may be needed from the under web to produce what is wanted in the chief pattern on the upper side, but there still remains the choice of an interchange of threads between the two inferior webs. It is obvious that the tendency to striping must be much less on this than on the common carpet, and that the designer having a far greater choice of colours, may produce effects that could not before have been obtained. After the principal figure has been determined on, the skill of the designer is most severely exercised on the wrong side of the carpet. His choice of materials is indeed as great as with the common carpet, but then he is hampered by the restriction in figure, and can only be entirely at ease opposite a piece of plain texture on the other side. The superior beauty of the triple carpet over the common ingrain or two-ply is at once acknowledged: it possesses almost all the freedom in colouring of the floor-cloth or paper-hanging, while its great thickness and comparative cheapness bring it into competition with the more expensive kinds of carpeting.

Fig. 105 is a correct representation, in perspective, of an imperial Scotch carpet loom.

The frame of the loom consists of four perpendicular posts A A A A, with capes B B, and cross rails C C C C, to hold them firm at suitable distances apart; these posts are generally 6 feet 4½ inches in height; D is the cloth roller, which must be made of well-seasoned wood of 5½ inches in diameter, with an iron gudgeon of ¾ths of an inch in diameter driven into each end of it, in the usual way; on one of these ends a ratchet wheel E is fastened, which is operated upon by two clicks F F, for the purpose of holding the web in its proper place when wound upon the roller by the weaver,

* Mr. M. is one of those sanguine mortals who believe, that if a man could produce a machine which would generate the power by which it was worked, he would become a creator! Oui!!

Fig 105.



in a similar manner to that formerly described in section 1st und
the head of plain weaving; G G is the lay or batten; H the ree
I the upper shell to hold the reed; J the under shell or sill of t
lay; K the rocking tree or cross bar, which connects the lay swor
G G above, as in Fig. 9, section 1st (which see;) L the harne
with double necking, connected to each of the Jacquard machine
M the treadles; N a rack or guide which serves to keep the treadle
in their proper places; O treadle cords or wires which connect the
treadles to their respective levers or lifters, in the usual way; P the
harness board; Q the warp roller, with its ratchet wheel R, similarly
fixed to that of the cloth roller D, and held in its place by the catch
or dog S, as in Fig. 7, section 1st (which see;) T the warp yarn as

it proceeds from the warp roller through the harness L, and from thence into the reed H, where it is woven into cloth, then passes over the breast beam U, and on to the cloth roller D; V the cloth; W a strong cord, fastened to the catch or dog S at X, passing over the pulley Y, and attached to the loom frame at Z, on the right hand side of the loom, and convenient to the weaver's hand; on this cord a small wooden bob A^1 is fixed, which the weaver pulls when he finds it necessary to draw his bore or sink, and he winds the same length of cloth upon the cloth roller that he draws of warp from off the warp roller; B^1 B^1 Jacquard machines of the common description, mounted on the top of the loom in the usual way; C^1 C^1 the pattern cards, and, D^1 D^1 two wooden boxes into which they drop when delivered from the cylinders, as represented more clearly in the description formerly given of the Jacquard machine, and in the drawings Figs. 93, 94, 95, 96, 97, and 98 (which see.)

The introducer of this texture (Mr. Morton) has conferred on us a very great benefit: he has furnished us with a higher embellishment for the interior of our dwellings, and presented to us another evidence of the active benevolence and social disposition of man. And it is agreeable to reflect, that in the nursing of the idea, and the carrying of it into effect, he must have felt a pleasure much more intense than is likely to be experienced by any of the multitudes who will enjoy the fruits of his abilities.

A desire for something in the interior of a dwelling analogous to the soft clothing of the external world, seems to be generally felt; for in all states of society attempts are made to remove the hardness and unseemliness of the floor. Among the poorer nations, these attempts are confined to the mere dormitories, but, as advances are made in wealth, the mat and carpet begin to appear. The softness of the turf and more than its smoothness having been attained, it was natural to imitate also its embellishments: for this purpose several distinct kinds of carpet texture have been contrived. On one of these (the ingrain) we have already reported an immense improvement, and proceed to describe a no less striking improvement on another.

The Brussels carpet is distinguished from the common one by having a raised pile, and by the circumstance that the figures and colours are entirely produced from the warp. The pile is raised by inserting a wire between the body of the warp and the previously raised colouring threads. These threads descend and are fixed by the weft, which is of linen, two picks being given before the insertion of each wire, and these picks are called binders, and after a few

repetitions of the process the wires are withdrawn, taking care that the wires be not drawn out too near the face of the cloth: otherwise the looped warp would become stretched, by recovering the position in which it was before the wires were inserted.

The Wilton carpet differs only in this, that the pile is made somewhat longer, and cut in the manner of velvet.* Were the coloured warp, however, raised into pile at each stroke, the web would have simply a striped appearance; and if it were raised only at intervals, the figure would be given in relief, but would still be merely striped. In order to produce a properly coloured pattern, several coloured yarns are arranged, so that any one of them may be raised, into pile. Their number is generally five, and these constitute what is called five covers, so that, by their irregular ascent to the surface, the striped appearance is almost broken up.† Still, however, the

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* The knife or cutter used in England, for cutting the piles of various kinds of fabrics, is a steel rod about 2 feet long and $\frac{3}{8}$ths of an inch thick, having a square handle at one end; the other end is tapered away to a blade as thin as the edge of a razor. To prevent the point of the knife from turning downwards and injuring the cloth, its under side is covered by a guide, which serves to stiffen it, as well as to prevent its under edge from cutting the fabric during the operation of guttering out the pile. The operative grasps the handle in his right hand, and insinuating the projecting point of the guide under the weft, pushes the knife smartly forward through the whole breadth of the pile (from selvage to selvage.) This process is repeated upon every line of the pile throughout the web.

An expeditious method of manufacturing common *velvets* has lately been introduced by our respected friend, M. Tannias Falson, of Lyons, its ingenious inventor. There are two principal features of novelty in this method the first of which is, the weaving of two webs or pieces of velvet at once, with one above the other, the pile of each turning inward, and the webs being connected together by the pile itself. The second feature consists of a vibratory cutter or knife, which passes between the two pieces of velvet and cut them asunder, as fast as woven, by the mere operation of the loom; the cutter is, of course, set from the face of the cloth at a sufficient distance to prevent its cutting too near the reed.

This excellent mode of manufacturing velvet, might, we think, be introduced with great advantage in this country: the necessary apparatus may be obtained, by applying to the inventor, at Lyons, or to Messrs. James Jacquier & Co., No. 1 Wood Street, Spitalfields, London.

† Called *covers* on account of all the colours being covered or hid, except *one*, which shows on the face of the cloth. In a pattern, for instance, containing five colours, all these may be visible, but only one will show at any particular point, and the sum of all the parts of the coloured yarns which appear on the face, will be only one fifth of the whole of the coloured yarns employed. Five colours are commonly used in the manufacture of Brussels carpet: if a

web is essentially striped, and though the designer be not nearly so hampered as in the Kidderminster texture, he is yet seriously incommoded in his choice. Let us suppose a board painted in minute coloured stripes. After these have dried, let another coating of coloured stripes be laid on, and so on for five coats, each differing from the preceding: the painter may now form an idea of the difficulties encountered by the carpet designer,—let him set to work, by scraping away the different coats, to produce a pattern. But there is another annoyance; *in order to produce the smallest speck of any particular colour, a thread of that colour must traverse the whole pattern; and that thread may displace some other which would have been advantageously brought in elsewhere.* On account of the very different rates at which the coloured threads are taken up, these cannot be wound upon one beam, but have to be placed each upon a bobbin by itself.

To remedy the inconvenience of this texture (the Brussels carpet) Mr. Richard Whytock, of Edinburgh, contrived a method of partially dying the yarns; but we cannot fully understand the value of the contrivance till we have glanced at another kind of carpet texture.

The Turkey carpet is the simplest in its texture of all carpets, and at the same time is almost unlimited in the choice of colours. Let us suppose ourselves seated at a common loom, and that immediately after having thrown a pick, we commence to tie on every thread of the warp a small bunch of coloured worsted yarns, varying the colour according to our fancy. This completed, let two or three picks be thrown, and well driven up; and then another row of coloured worsteds tied on. It is clear that in this way we could produce any pattern, and that no more of any particular colour is wanted than is sufficient to produce the required effect: nay more, the colours being put on by hand, we would not be compelled to reiterate the pattern at each stated distance. Here we have every advantage that we can wish for, excepting this important one, rapidity of formation.

Whytock's method supplies to all the advantages of the Tur-

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greater number were employed, the cloth would have a flimsy appearance. Suppose ten colours to be used, instead of five, as already described, then nine of them would always remain below, while only one would be raised, but this one could not fully conceal the others, so that the pattern on the cloth would be indistinct. Could one-half or two-thirds of the coloured threads be brought to show on the face of the cloth, it is clear, that the fabric would have a much more dense and velvety appearance.

key carpet, a rapidity of weaving greater than that of the Brussels fabric. His method may be described thus: If for the five coloured yarns of the Brussels carpet we could substitute one yarn dyed of the requisite colour at different places, we would be able to dispense with all the apparatus for producing the pattern, could make the web with only one body, and work it as a simple velvet. The only difficulty would then be in the dying of the warp threads.

In order to dye the threads, one yarn is wound on the surface of a large drum, of which the circumference is equal to the length required for one copy or length of the pattern. This drum is graduated so that the dyeing roller can be passed across the yarn at any required place. The design, extended on the ordinary ruled paper, enables the workman to discover all the places at which a particular colour is to be applied: that done, he changes the colour box, and so proceeds till the whole colouring is completed. The thread, being now dyed, is then taken off the drum, and submitted to the processes (steaming &c.) for fixing and brightening up the colours. The second thread is then dyed, and so on till the whole warp is finished. The next and most difficult part of the operation is, to place all these yarns side by side upon the beam. For this purpose they are wound upon separate bobbins, and small white spots, purposely left in the dying, enable the workman to arrange the coloured parts properly opposite each other. They are then carefully rolled upon the beam, and the weaving proceeds rapidly, each thread being brought into the pile upon every successive wire. Whytock uses the grooved wires, and cuts the pile in the manner of the Wilton carpet.

Excepting the necessity for the recurrence of the pattern, this has all the advantages of the Turkey carpet. The coloured spots can be produced at any point, and need not run in rows as in all the other carpets. It need hardly be added, that greatly admired patterns have been produced by this method; and that the manufacture meets with deserved encouragement.

Before concluding this imperfect notice of these two improvements (Morton's and Whytock's) we would draw attention to a subject of great importance to society in general. A strong prejudice, sanctioned by an old proverb,* exists against those who turn their attention to several branches of the arts. Yet it is a fact, that almost every improver has been jack of a good many trades; nay, an ac-

* "Jack of all trades and master of none."

quaintance with a variety of operations is essential to the invention of new ones; and very often prodigious improvements are effected by the simple transference of a process from one art to another.* May we be allowed to hint, that the triple carpet is one of those generalizations so often found in scientific researches, and that its inventor appears to have extended his studies far beyond the subject of carpet weaving. Whytock's carpet, again, bears on the face of it the necessity for a knowledge of the arts of dyeing, weaving and scheming; for no one not intimately versed in these could have conceived, or, having conceived, could have carried the idea into effect.

Another idea exists, that the happening upon new discoveries is a matter of chance, and some appear (we judge from their conduct) to imagine that the less they know of a subject the more likely are they to alight on something new; as a bad swordsman trusts to that very circumstance for outwitting his antagonist. Once in a century, indeed, one man among seven hundred and fifty-nine millions may find, by chance, some valuable process; but the great mass of our current inventions are the fruits of assiduous and well-directed exertion; and the mind, even more truly than the body, must earn its bread in the sweat of its brow.

For the benefit of the manufacturers in Great Britain, who are interested in the carpet trade, we have, at very great trouble and expense, made correct drawings and specifications of Mr. Whytock's very ingenious machinery for colouring carpet yarns, according to the statements just made: and although we have been out of pocket several hundred dollars more than we at first anticipated in this matter, still, we regret it not, believing that our exertions will meet with an adequate reward. We have made all the drawings to a scale.†

This invention consists of a new method or manufacture, which facilitates the production of regular figures or patterns, on different fabrics, particularly velvets, velvet pile, and Brussels, Wilton and Turkey carpets, by colouring the threads or yarns which are to be

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* As, for instance, the stealing of other men's inventions, and passing them off for our own. It often occurs that schemers, by such low trickery, succeed in acquiring large fortunes, whereas, the ingenious persons whom they thus swindle not only out of their bread, but also out of the *honour* which they justly deserve, die for want of the common necessaries of life.

† We think it proper to mention, that these drawings were made from one of Mr. Whytock's machines, *while in operation*, at Tournay in Belgium; and we were assisted in making them by Judge Shinimigin of Brussels.

used in weaving such fabrics, with a succession of different colours applied at different portions of the length of each yarn, according to such a peculiarly regulated order of succession of colours, as that after the yarns (so rendered party coloured) have been suitably arranged, in a simple loom, such as is commonly used for weaving plain cloth, without any Jacquard or other figuring machinery thereon, and after the said yarns have been woven, particularly into any of the fabrics aforesaid, by the ordinary manipulations of plain weaving, the cloth shall exhibit the appearance of a pattern or design, in diverse colours, by virtue of the variegated colours which were previously applied on the yarns by this improved method, according to a suitable and peculiarly regulated order of succession of colours, as aforesaid.

And although certain yarns which are intended for weaving patterned fabrics by plain weaving, have been heretofore rendered party-coloured, by tying up part of the hanks or skeins in order to preserve them free of colour when the other parts are coloured, by submitting the whole hanks or skeins to a dying process; and also, by a more recent process (practised by Mr. Louis Schwabe of Manchester) such yarns have been rendered party-coloured by printing them whilst they are in skeins or hanks; and the yarns so rendered party-coloured, whether by dying or by printing, are afterwards arranged in the loom, so as to give to the fabric which is woven therein, the appearance of certain irregular and ill-defined patterns in single or party-colours, such as clouded, speckled, mottled, marbled and spotted patterns, and interrupted striped patterns; it is to be understood that this improved method or manufacture, of Mr. Whytock's, is founded on the same principle of previously rendering the yarns party-coloured, and afterwards arranging them in the loom so as to produce a fabric with a variegated pattern by plain weaving of the party-coloured arranged yarns. This improved method, by virtue of certain mechanical combinations and arrangements, hereinafter described, for performing the process of rendering the yarns party-coloured, with a suitable succession of colours, (and after the same are suitably arranged in the loom certain precautionary measures, hereinafter described, being used, in order to keep up the said suitable arrangement unchanged during the process of plain weaving,) will facilitate the production of regular figures or patterns, which will correspond with sufficient accuracy to a previous, and intended design, and will be repeated with sufficient accuracy at regular distances along the length of the woven fabric, so as to exhibit the same appearance as is usual in the regularly

figured or patterned fabrics, which are woven in figured looms, but which regularity and accuracy of patterns have not been hitherto obtained by the ordinary mode of dying or printing yarns in the hanks or skeins.

We are aware of the fact, that yarns prepared for weaving into figured fabrics, by plain weaving, by printing suitable impressions in diverse colours upon them to form the chain or warp of the intended web, and passed through reeds like those of the loom which is intended to be used for weaving the same, the said impressions being obtained from engraved metal surfaces or from carved blocks, in the manner practised by calico printers, according to which method of printing warps, the pattern which will be afterwards exhibited by the fabric woven out of such printed warps, will be the same in respect to its design as that which is engraved or carved on the surfaces or blocks, by which the impressions were printed on the warp, except in as much as the design may be contracted in length by the gathering up of the warp in the process of weaving.

It is to be understood, that according to Mr. Whytock's improved method, the yarns, when they are arranged in a warp in preparation for weaving, are not printed; nor does he make use of engraved surfaces, or carved blocks, with any figured design or pattern thereon which bears the least resemblance to the figured design or pattern which will be exhibited by the woven fabric; but, with the same mechanical combination and printing implements which he uses for rendering yarns party-coloured, as aforesaid, suitable for the production of one kind of regular figures or patterns on the woven fabric, he can, also, render yarns party-coloured suitably for the production of an unlimited variety of different regular figures or patterns by only varying the regulated order of succession, whereby he applies the different colours to the yarns, with his mechanical combinations and printing implements; and according to which improved method, the warp or chain is formed in preparation for weaving after the yarns are rendered party-coloured, which is also the case in the common plan of dyeing the yarns in the hanks or skeins, tied up, or in printing the yarns in the hanks or skeins: in the old methods, the warp or chain is formed first, and the printing afterwards performed thereon, and the yarns of their printed warps (or so many thereof as are to form the patterned or figured part of the fabric) must retain the same positions in relation to each other when they are in the woven fabrics, that they had during the printing, for the yarns receive their printed impressions whilst they are arranged in the same order side by side as that which they

are to have when arranged in the loom. This distinction being made, we shall now proceed to explain the improved method or manufacture in all its essential details.

In order to render yarns party-coloured by Whytock's improved method, one yarn or thread, or a small number of yarns or threads, must be wound or coiled around the circumference of a large cylinder or drum, which is mounted on a horizontal axis in a frame, *in the manner of a grindstone*, and the circumference of the cylinder being covered with a blanket, such as is used by calico printers to cover over their tables for block printing, with the addition of an oiled cloth cover, to keep the blanket clean, the circumvolutions or coils which the yarn or each of the yarns makes around the said cylinder, being disposed regularly and closely side by side. And if more than one yarn is wound round the cylinder at once, the coils thereof should be continued until they fill up close to the side of the first coil which was made by the next adjoining yarn, so as to cover all the circumference of the cylinder with circumvolutions of the yarn or several yarns around the same. The yarn or yarns being thus disposed in coils around the cylinder, and the ends fastened thereto, they are prepared for receiving the colours, which are applied by means of long narrow sticks or rulers, the edges of which are covered with felt, and are used as printing surfaces, in the manner of calico printing blocks, *but without any carved pattern* on the said edges or printing surfaces; that is to say, the felt edge of one of the said rulers being furnished with its appropriate colour (from a colour seive, such as is used by calico printers for block printing,) is applied horizontally across the breadth of the cylinder, parallel to the axis thereof, so as to cross over the coils of the yarn or yarns which surround the cylinder; and an impression being given across the yarn or yarns by the printing surface or edge of the ruler, in the same manner as would be done by calico printers, it will apply colour to each circumvolution of the yarn or yarns, along so much of the length thereof as is equal to the breadth of the printing surface of the rulers; and as the yarns or each yarn makes several circumvolutions around the cylinder, the colour so applied will colour as many different places along the length of each yarn, and those places will be exactly at equal distances apart along the length of the yarn, viz. at distances apart equal to the circumference of the cylinder. After one impression is thus made on the yarn or yarns, the cylinder is turned round just as much as will move its circumference a space equal to the breadth of the impression left by the ruler, and then, if the pattern requires a change of

colour, another similar ruler, furnished with a suitable colour, is applied across the yarns, so as to make another impression thereon adjoining to the former ; or, if the pattern does not require a change of colours, but the repetition of the same colour, the same ruler which was first used, being furnished anew with its own proper colour, is used to make the second impression, instead of a different ruler ; after which the cylinder is again turned round as much as the breadth of the impression left by the last ruler, in preparation for laying another impression, either with the same ruler which was last used refurnished with its own proper colour, or else with a different ruler furnished with a different colour, according as the pattern requires a change of colour, or a continuance of the same colour, on the next succeeding portion of the length of each yarn.

When repetitions of the same colour are frequently required, the colouring may be expedited by using a broader ruler, which will print double or treble the space of the ruler before mentioned. In this way the colouring of the yarns proceeds along all parts which require to be coloured by successive impressions of the different colours, with repetition of the same colours, or a change from one colour to another, according as the pattern requires, until a complete series of such impressions has been made, reaching all round the cylinder; and which series, by joining up to the first impressions, will complete the colouring of the whole length of the coils of yarn around the cylinder with their required party colours, succeeding each other in due order of succession, according to the pattern they are intended to produce in the woven fabric. When one yarn, or one small number of yarns, has been thus rendered party coloured, it, or they, must be taken off the cylinder, to be afterwards, when dried, subjected to the action of steam, to fix the colours, and then washed, and when again dried, to be wound on a bobbin, or on bobbins, in preparation for forming it or them into a warp; and as soon as the cylinder is at liberty, another yarn, or another small number of yarns, is coiled upon the cylinder to be in its, or their turn, rendered party coloured, by a similar series of manipulations, and so on until the whole number of yarns which are required for the formation of the warp or chain of the intended fabric, or of the figured or patterned portion thereof, are rendered party coloured; and, in applying the colours to each yarn or small number of yarns which are wound each time round the cylinder, the order of succession of the different colours is varied as the pattern may require, for each yarn or small number of yarns; and when the whole of the yarns requisite for the warp (or for the figured or patterned portion

thereof) are finished and gathered on their separate bobbins, either the said party coloured yarns are drawn off from the bobbins to form the warp in the loom by degrees, as the yarns are required for the weaving, or else the yarns are collected from the said separate bobbins on to the yarn beam of the loom by the usual process called beaming, as a preparation for weaving; and in so collecting the party coloured yarns from off their different bobbins into a warp, whether it be by degrees as the weaving in the loom requires, or in order to beam the warp upon the yarn beam of the loom previous to the weaving, the several party coloured threads must be arranged side by side, each in its proper place across the breadth of the warp, according as each yarn has been previously rendered party-coloured, suitably for the place it is required to occupy in pattern. And, owing to the circumstance of each yarn making several circumvolutions around the cylinder when the colours are applied thereon, as herein before described, the order of the succession of the party-colours on each yarn will be exactly repeated at intervals along the length of each yarn equal to the circumference of the cylinder, and those repetitions of the order of succession in the warp will produce repetitions of the figured pattern in the length of the piece of the fabric when it is woven. Wherefore, the length of the circumference of the cylinder must be adapted to the length over which the pattern is required to extend, before a repetition of the pattern commences, allowing for the contraction of length which results from the gathering up of the warp in the process of weaving, or else the circumference of the cylinder may be twice or thrice the length of the yarn required to produce that length of the fabric over which the pattern is required to extend before a repetition commences. The warp being thus composed of party-coloured yarns, suitably variegated with colours, and arranged in suitable order in the warp, according to the intended pattern, the weaving is to be conducted in the usual manner of what is called plain weaving, and will produce a fabric with a figured pattern in colours *without any of the troublesome manipulations which are necessary for what is called figure weaving*. The fabrics for which Whytock's improved mode is most particularly adapted, are those wherein the surface of the fabric which exhibits the pattern is composed chiefly by gathering up the warp into loops, by interlaying a wire during the operation of weaving across the warp in the direction of the shoot or weft, and which wire may be either drawn out in order to leave loops for the face of the fabric, as is the case in Brussels carpets, or the wire may be cut out, if it is intended to

form a pile for the face of the fabric, and the cut or divided loops will form that pile, as is the case in velvets, velvet piles, and Wilton carpets; and, as to Turkey carpets, which are a different description of fabric from the others above mentioned, being formed by knotting tufts of coloured worsted yarn around the yarns of the warp, Whytock's improved mode facilitates the production of regular figures or patterns thereon, by enabling the operator to render the skein of yarn which each weaver is to use for forming those knotted tufts party-coloured, with the different colours succeeding each other, exactly according to the order of succession of colours in which the weaver must introduce tufts of different colours. According to the ordinary mode of weaving Turkey carpets, the weaver must have in use as many different skeins or clews of different colours as the variegation in his pattern requires, and must select first a skein or clew of one colour, and then another, with discretion to suit his pattern; he will, according to this improved mode, require to use only one skein or clew of yarn, which, being rendered party-coloured in due order of succession of colours, will furnish all the variation of colouring necessary for forming the successive tufts which he will require in his work, and following each other in due order as they will be wanted. And as he works up the skein or clew of party-coloured yarn by putting in tuft after tuft, and cutting off the yarn each time, those successive tufts will change their colour according to the intended order of succession of colours which the pattern requires, without any trouble of selecting colours and changing skeins with *perpetual* reference to the pattern, as heretofore, but only *occasional* reference thereto, and without the same liability to mistake in so selecting, and the waste of coloured yarn which is occasioned by such mistakes; and also, the number of ends remaining from the number of skeins which must be used will be much diminished by rendering the yarns party-coloured, according to this improved mode, and likewise, by this mode of party-colouring the yarns, the joinings of the patches of colour which were applied successively, will indicate the exact place where the yarn is to be cut off as the tufts are introduced, whereby waste of material in cutting off too long may be avoided, as well as imperfections in the face of the work by cutting off too short.—Note, a saving of colouring material may be made in rendering the yarns for Turkey carpets party-coloured, by an improved method, by omitting to apply any colour to those parts of the yarns which are afterwards to be looped or knotted around the yarns of the warp, and which parts will therefore appear only at the back of the fa-

bric, and will consequently require no colour; these omissions can be easily made in their proper places along the party-coloured yarns, by setting out the pattern so that those parts of the yarns will be known when they are wound round the cylinder, and may be passed over without applying any colouring matter thereon. The places which are so left uncoloured in the yarns will be *extremely useful* as indications to the weaver of the places where the tufts are to loop and knot around the yarns of the warp.

Fig. 106 represents the cylinder A A in perspective, together with the rack B B containing the bobbins *a a*, from which the yarns *b*, are furnished to the cylinder A A as fast as they are wanted, when the latter is turned round in order to wind them around its circumference, as herein before mentioned. Figs. 112 and 113 also represent the cylinder, and the same letters of reference are used to denote the same parts in all the figures. C C E L Fig. 113, and K K L Figs. 114 and 115 is the wooden frame for supporting the axis D of the cylinder A A; E L (see Figs. 113 and 114) are upright standards to support a horizontal shelf or rest F, which is fixed across the width of the cylinder, and serves to place the rulers by which the colour is to be applied to the yarns, in a truly horizontal position, and so that each ruler will be presented to the cylinder A A at the same height thereon; *d d*, (see the Figures 107 and 109) is a guide screw, which is mounted horizontally in bearings notched out in each of the upright standards E L (see Fig. 113;) the screw *d d*, has a pulley *e*, fixed on the extreme end of it, in order to turn it round by means of an endless band or strap *f f* (see Fig. 112,) from another pulley *g*, which is fixed on the extreme end of the axis D of the large cylinder A A; wherefore, the screw *d d*, will be turned round with a motion corresponding to that wherewith the cylinder A A is turned; G G (see Fig. 107) is a conductor for the yarns which is fitted on the guide screw *d d*, so as to be moved gradually along thereby across the width of the cylinder A A, when the latter is turned round. The rack or frame B B (Fig. 106) contains as many bobbins *a a*, as the number of yarns which it is intended to wind around the cylinder A A, for colouring at one operation.—A yarn *b*, from each of the several bobbins *a a*, is conducted beneath a fixed horizontal rod or wire *h*, then over another such rod or wire *i*, and beneath a third fixed rod or wire *k;* which three rods or wires, by opposing a slight friction to the yarn or yarns when drawn across the rods or wires, will cause the yarn or yarns to be extended with a proper tension when drawn afterwards by the cylinder A A. After passing under the third rod or wire *k*, each of the several

yarns is passed through a distinct eye in a wire guide *z z*, (see Figs. 106 and 107) which is fixed upon the top cross rail R of the conductor G G (see Figs. 106, 107, and 108) and, finally, each of the yarns is passed through a wire loop *m*, which is fixed in the top cross rail R (see Figs. 107 and 108) and projects so far out therefrom as to reach near to the circumference of the cylinder. *n*, (see Figs. 113 and 114) is a fixed rest or guide for the tails of the conductor G G to bear against, when the screw *d d*, is turned round, and as it carries the conductor G G literally across the width of the cylinder A A in the manner before stated, and in so moving it will guide each of the yarns, so that the successive coils which that yarn makes around the circumference of the cylinder will fall close to each other side by side; and, if that coiling is continued until the last coil made by one yarn joins up to the first coil made by the neighbouring yarn, then, the whole surface of the cylinder will be covered with the several yarns.—The conductor G G is made double, and fitted upon the screw *d d*, near to each end thereof, the two conductors G G being united by two wooden rails R S, and each part which is so fitted on the screw *d d*, is formed in two parts G *p*, (see Figs. 107, 108, and 109) which are jointed together at *q*, in the manner of a pair of pincers, to grasp the screw *d d*, by the action of the spring *r*, which is interposed between the handles G *p*, of the two parts, in order to urge them apart from each other, and cause the other parts *s s*, of the pincers to grasp the screw *d d* between their jaws, by clasping the two handles G *p*, of each of the conductors together in the hands, their spring *r*, can be overcome to open the two pincers, and then both the conductors G G become detached from the threads of the screw *d d*, in order to move the whole back from one end of the screw to the other, without the trouble and delay of turning the screw round backwards after one set of yarns has been wound round the cylinder, in order to prepare for winding on another set.*

Figs. 114 and 115 represent the cylinder as it appears when a part H H of its circumference is folded inwards towards the axis, in order to admit of taking off the yarn from it after it has been rendered party-coloured. Two portions H H of the circumference are

* A more simple guide or conductor for coiling the yarns on the cylinder A A, as represented in Figs. 106, 107 and 108, may be used; and as every manufacturer of cotton goods in Great Britain is well acquainted with the common traverse or spooling motion, no difficulty can be experienced by them on this head. We are confident that the manufacture of this kind of carpet, (the velvet pile) is destined ere long to receive vast improvements: indeed, we would not be at all surprised to see from 25 to 30 yards of it manufactured

attached to the remaining portion of the circumference by hinge in the manner of a pair of folding doors; also, a portion I I of eacl of the rims and arms of the cylinder is attached to their centra naves on the axis by hinges, so as to admit of folding those portion of the rims and arms down out of their proper places, and then th two portions H H of the circumference by dropping in towards th axis, will slacken and set the yarn free upon the cylinder, in orde that they may be removed or doffed from off the same, in like manner as a common yarn real is doffed when it becomes covered witl hanks of yarn. And, in order to admit of so doffing the yarns fron the cylinder, the side K K L of the wooden frame (Fig. 114) whicl supports one end of the axis D, is made to turn down in the manner shown in Fig. 115, about hinges at its lowest part, by whicl hinges it is attached to one of the ground sills of the frame; and when the side K K L is placed upright in a proper position t support the cylinder, as is shown in Fig. 113, it is retained by a oblique strut M, which is also attached by a hinge at its lowes end to the cross sill of the frame, so that it can be turned down ou of the way in the manner shown in Fig. 115, when the side K K I of the frame is to be turned down.—Note, before that side is s turned down, the weight of the cylinder A A must be suspended a shown in Fig. 115, by a tackle of pulleys N, applied in an obliqu direction between the arms of the cylinder from a support at th ceiling of the room, and reaching to the end of the axis D of th cylinder. The cylinder is framed with two sets of arms, upon th two ends of the axis, and two circular rims on those arms as show on the drawings. The circumference is composed of boards fixe across the edges (as in the construction of card drums) of the tw rims parallel to the axis of the cylinder, and the outside circumference being formed to a true cylinder, is covered with a printe blanket strained tight and sewed.—A covering of oiled or varnish cloth is spread evenly over the blanket, and secured thereto by pi The yarns are wound round the covering of oiled cloth in order receive their colour, but the said oiled cloth cover is unpinned, a removed from the cylinder along with the yarns when they a doffed, in order to preserve them from blurring their colours handling in doffing.

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per day, of 12 working hours, in a machine of comparatively simple constru tion, superintended by one person only. We are always willing to do our most in advancing the manufactures of this country, being deeply impress with the idea, that on them, in a great measure, depends our prosperity a nation.

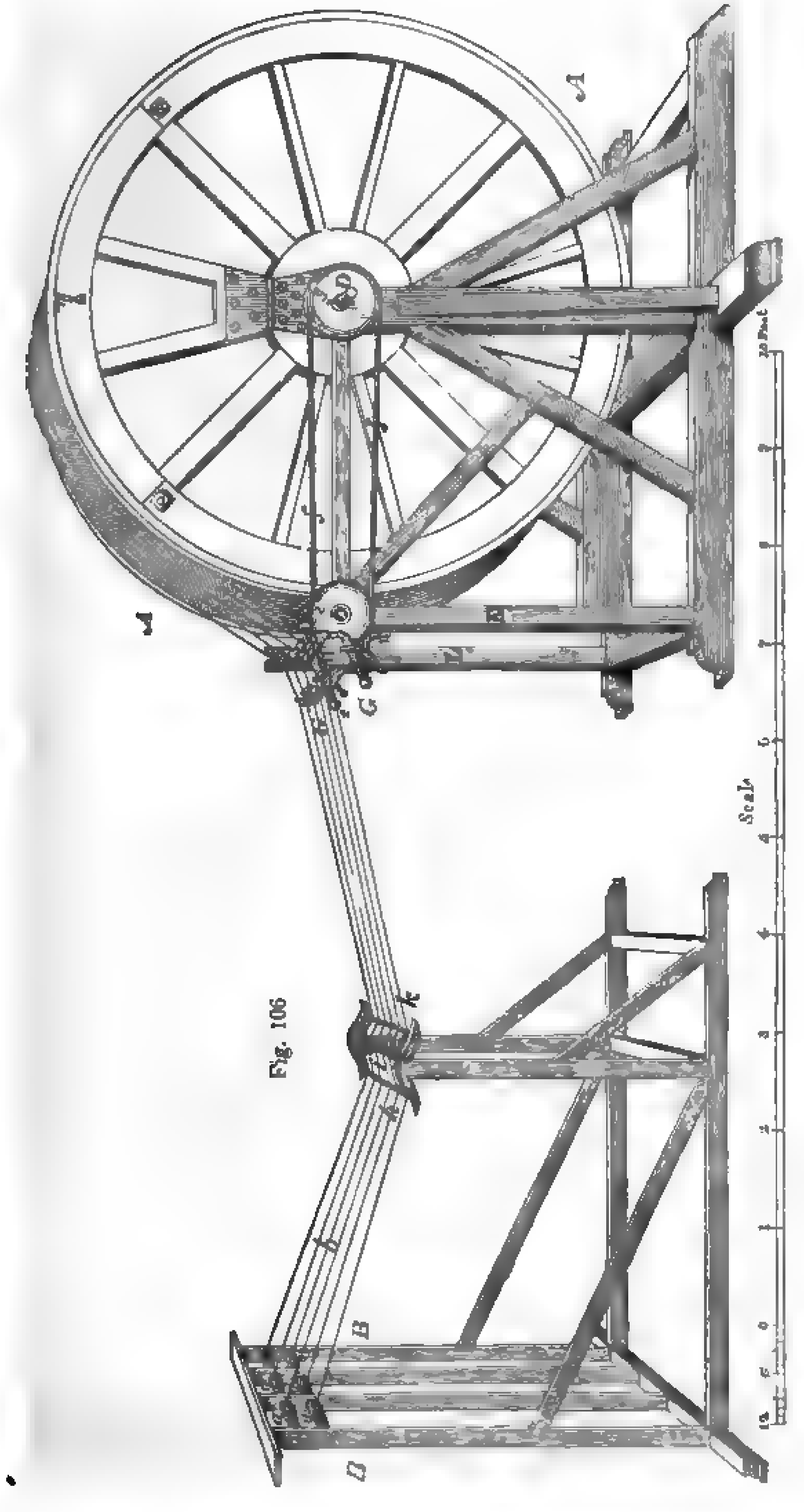


Fig. 106

Figs. 107, 108, 109.

Fig. 107.

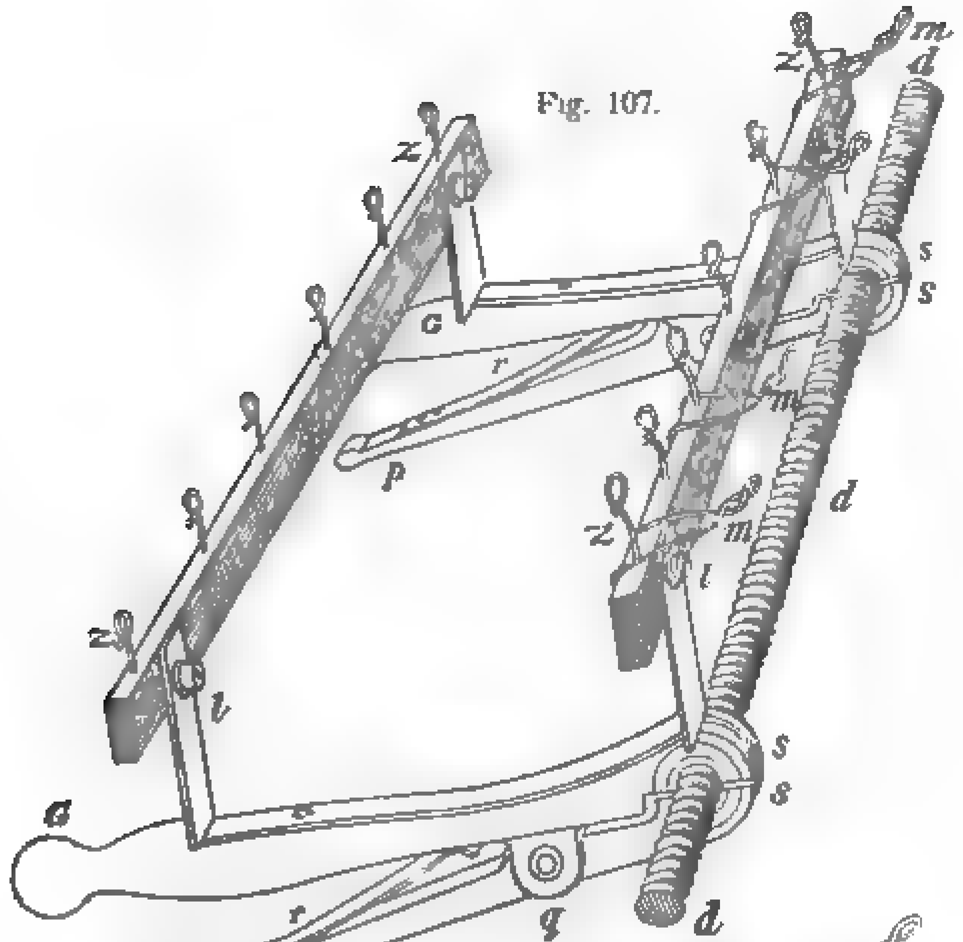


Fig. 108.

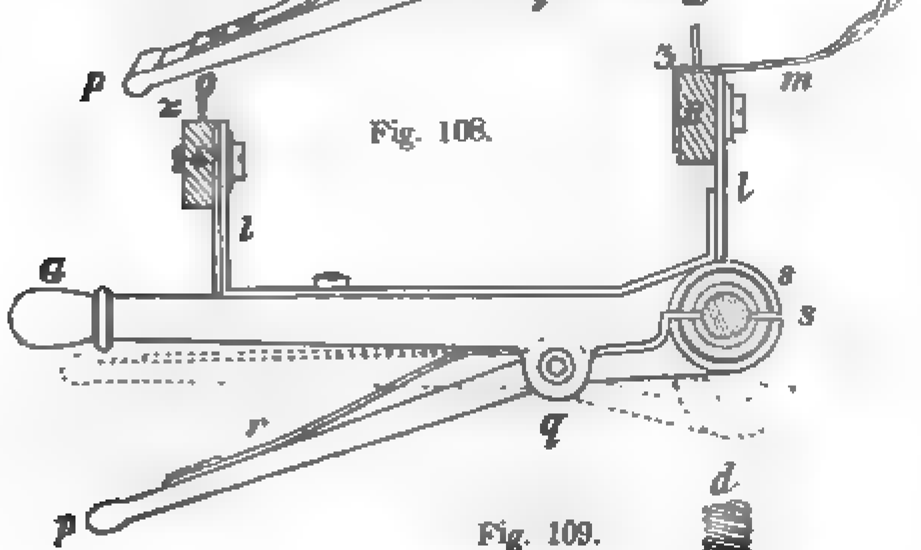


Fig. 109.

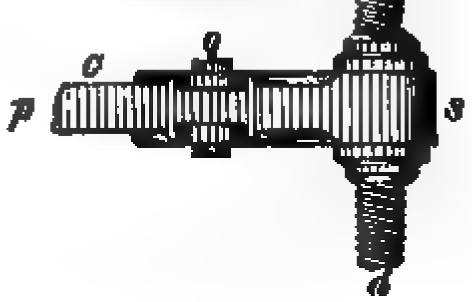
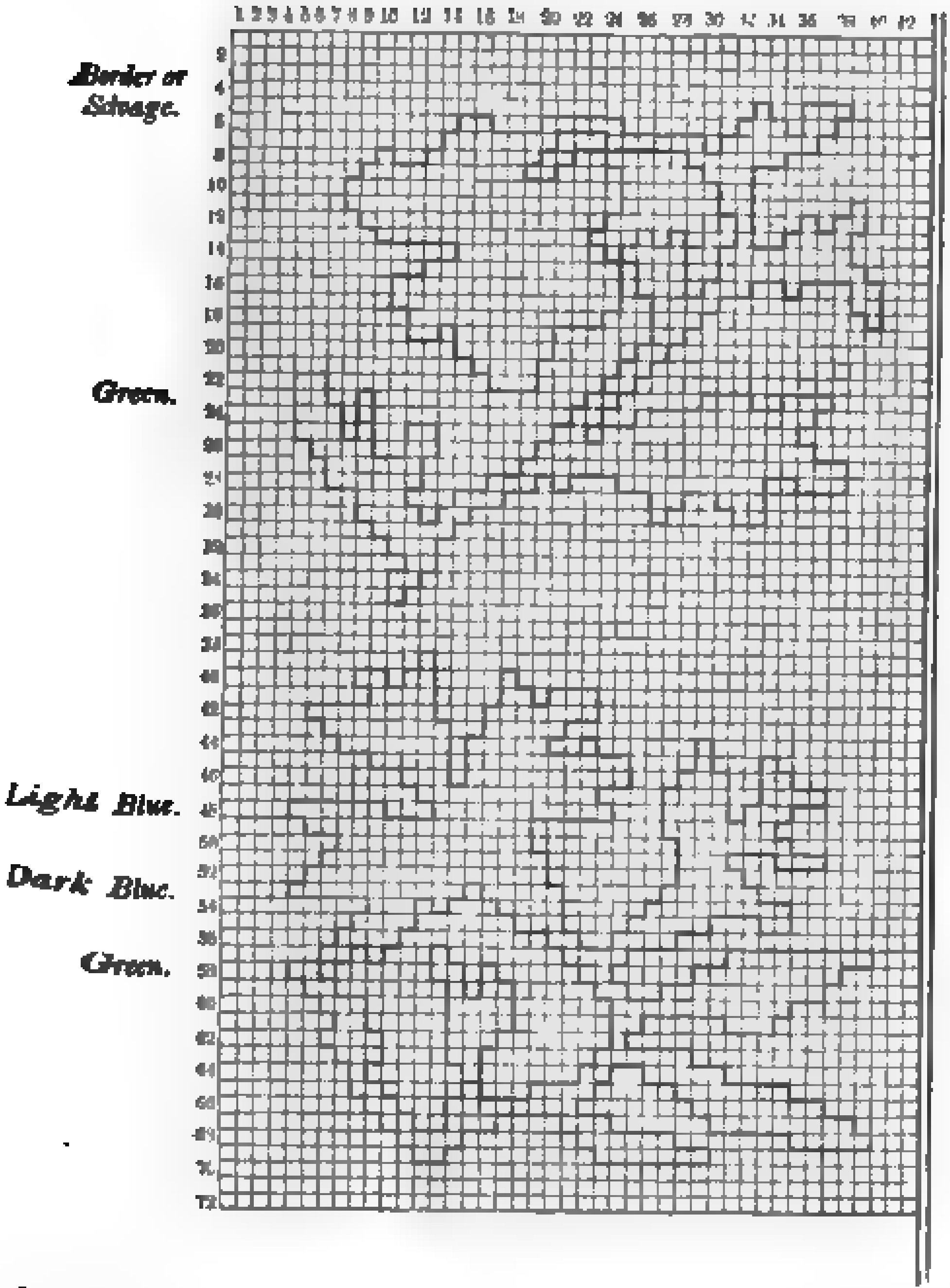


Fig 110.

Fig 111.



Note.—The above species of painting or of transferring patterns to the design paper is performed with camel hair pencils, and appropriate pigments, which are to be reduced, if necessary, to a semi-transparent state. The pencils should be chosen of a middle size, with a good spring and point, both of which qualities may be discovered by drawing them gently through the mouth, and pressing them on the thumb nail; when, if on being moderately wet, they spring again into their form after being bent, (on the nail,) it is a sure indication of these qualities. The points of the pencils too, should be adapted as nearly as possible to the size of the small spaces or squares on the design paper on which they are to be employed, that the designer may be able to fill any individual space with only one touch of the pencil.

A learner in this department, before he attempts designing of patterns, should endeavour to acquire a dexterity in filling up these little spaces on the design paper, whether they run in straight or curved lines; taking care always to fill them exactly, without allowing the paint to spread beyond their boundaries, or leaving any of them broken or imperfect.

Fig 112.

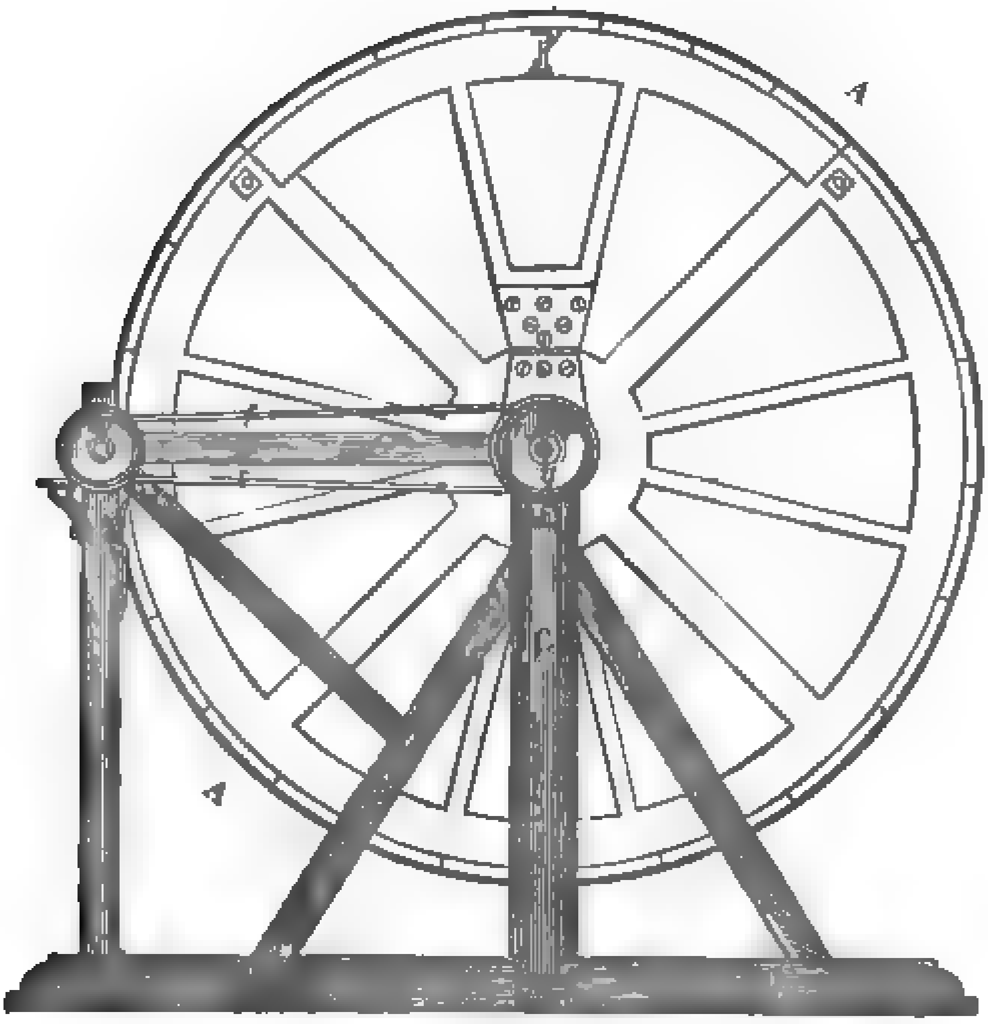
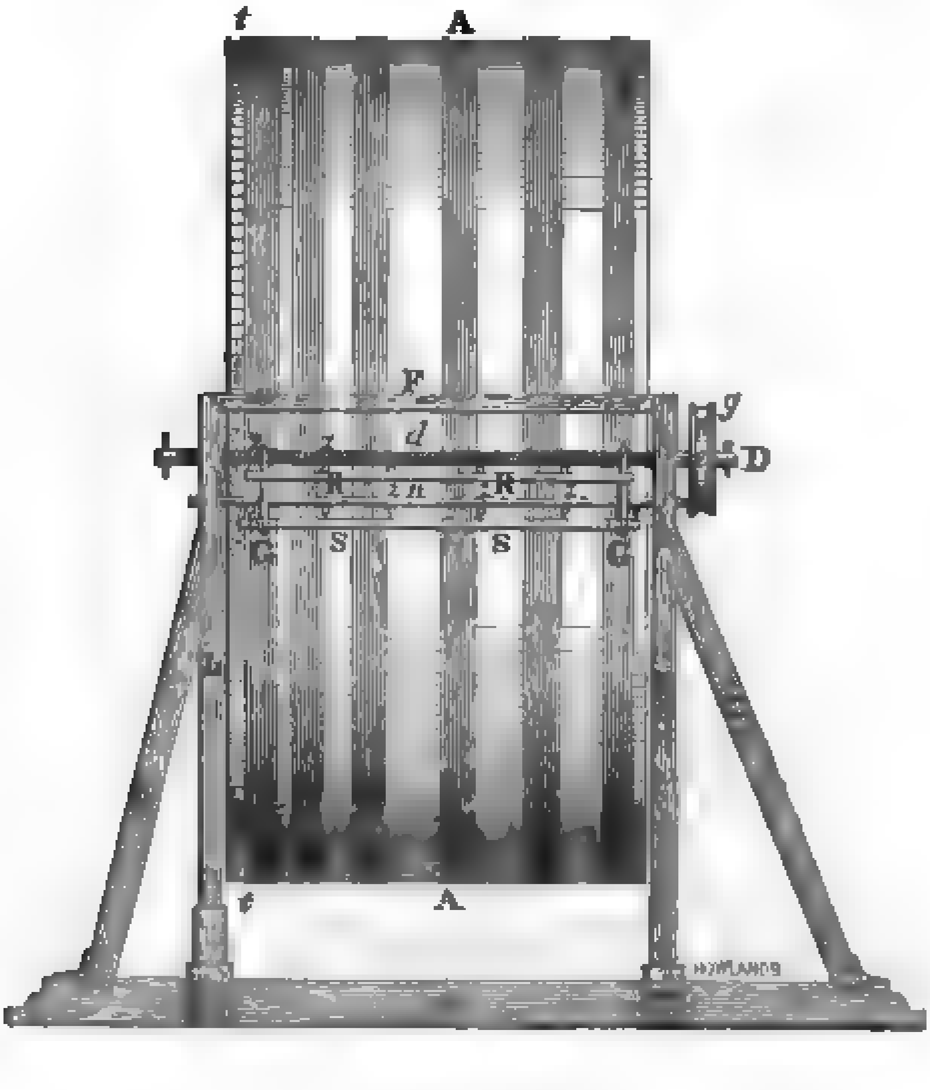


Fig. 113.



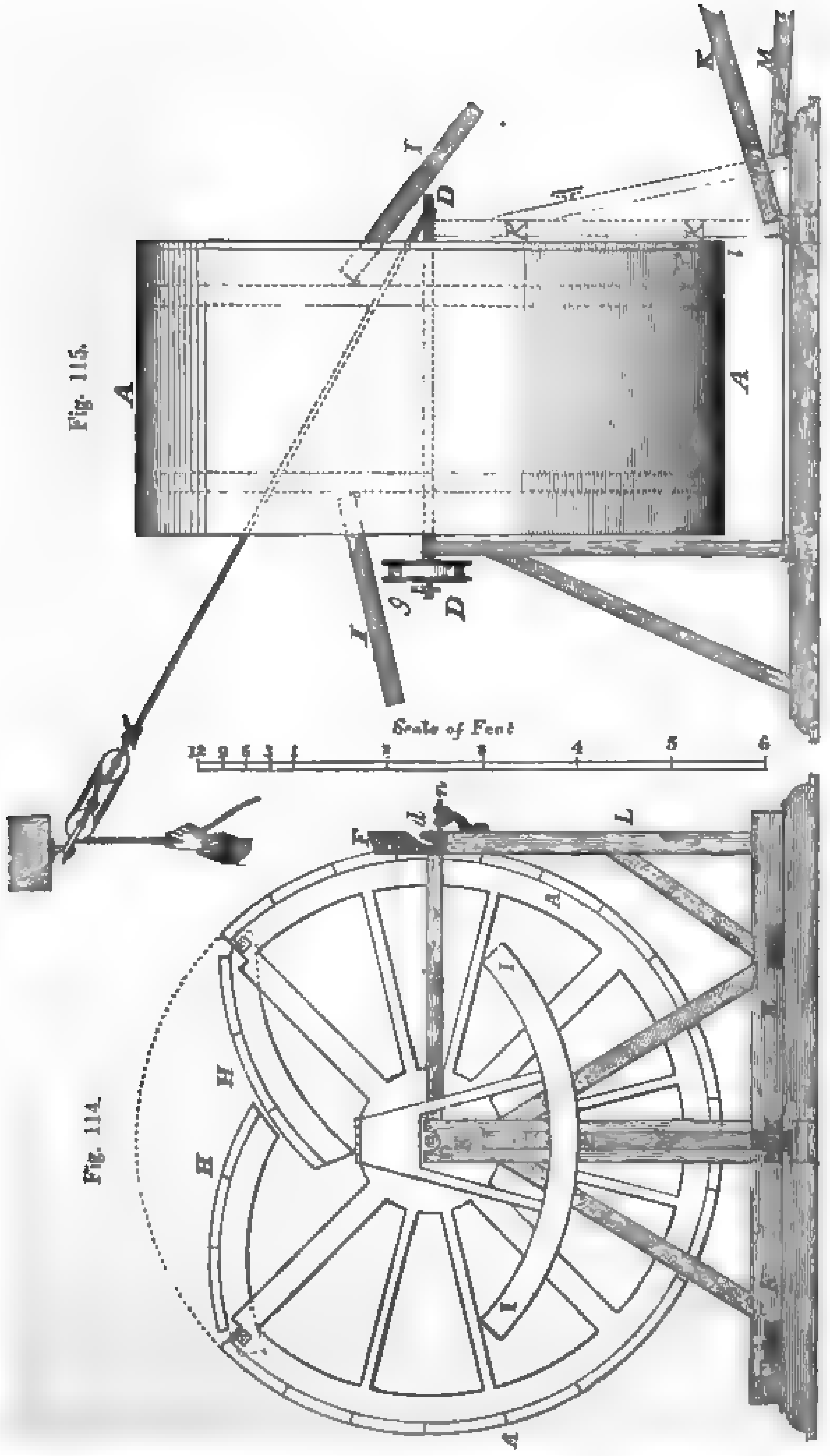


Fig. 115.

Fig. 114.

Description of the manner of applying the party-colours on the yarns, and of determining the proper order of succession for the different colours thereon.

The succession of colours must be determined by means of a design paper, which represents the design or figured pattern intended to be produced by plain weaving of the party-coloured yarns. See a specimen of such a design paper Fig. 111. It is similar to the design paper used by weavers for figured weaving, being ruled with squares, which are numbered across the top and down the length, and it must contain the entire figure of the pattern which it is intended to produce in the fabric, and which pattern is to be repeated thereon at regular intervals along the length of the piece: and, supposing that the ground whereon the pattern, Fig. 111, is to be represented, is to be all of one uniform tint, the whole of the yarns may be dyed with that colour previously to applying the party-colours, the said dye being chosen of such a nature that it will readily give place to the stronger party-colours which are to be applied.* The size of the cylinder A A must be so chosen that its circumference will be equal to the length of yarn which the warp will take up for weaving, from the commencement to the end of the pattern, where it will join to the preceding, and to the succeeding repetition of the pattern, taking into consideration the contraction of the length of the warp which will result from the gathering up of the yarn in weaving, and which contraction varies very greatly in different kinds of fabrics. Whatever number of squares the length of the design paper occupies, (for instance 72, as in Fig. 111,) the circumference of the cylinder must be divided into a like number, (of 72 equal parts;) or the double or the treble that number, if the cylinder is large in proportion to the pattern; which is easily done by applying a tape painted with suitable divisions upon it around the circumference of the cylinder, as at *t t*, (see Fig. 113) and fastening it with pins to the blanket cover. The design paper should be laid out in large squares, as the printer has to distinguish readily the succession and order of the different colours. It may either represent a figure to fill the breadth of the intended fabric, or one which is to be repeated several times side by side in the breadth, and each square may either represent a single yarn or a number of yarns, according as the texture of the fabric is to be fine or coarse.

* The operator must be careful not to apply light pink, light yellow, sky blue, pea green, or French white on a black or dark *bottom*, as none of these delicate tints would appear to advantage on such a surface.

Repetitions of the same figure in the breadth will admit of several yarns being coloured alike at one operation, and the trouble of afterwards separating these yarns may be avoided by keeping the coils of the different yarns distinct from each other upon the cylinder. The numbers along the top border of the design paper, Fig. 111, (for instance, from 1 to 43 in Fig. 111,) represent the different sets of yarns in the warp which are to be rendered party-coloured together by one operation. Suppose, for instance, that it will take six yarns of the warp, side by side, to fill each of the squares across the breadth of the fabric, that will be 6 times 43 or 258 yarns, side by side, in the whole warp, to produce the pattern Fig. 111. In that case 6 bobbins *a a*, Fig. 106, must be used, and as many yarns must be wound together round the oiled cloth covering of the cylinder A A, by attaching their ends thereto with pins, and then turning the cylinder round by a suitable crank. The traversing motion which the screw *d d*, then gives to the conductor G G, will lay each of the six yarns in regular coils close side by side on the cylinder, so that the succeeding coils of each yarn will just touch one another. The number of circumvolutions of each yarn which must be thus wound upon the cylinder, will be determined by the number of repetitions of the pattern required to be made in the whole piece of the fabric which is intended to be woven for one warp; and when the required length of yarns is wound on, the successive coils made by each yarn will cover up the space allotted for it on the breadth of the cylinder, so as to join to the space allotted for the next yarn, whereby the whole surface of the cylinder will be covered with coils; which being done, the ends of the yarns are cut off and secured to the oiled cloth covering of the cylinder with pins, and then those yarns are ready to receive the party-colours from the printing rulers or sticks, in the manner herein before described; and it only remains to explain how the proper order of succession of colours is determined by aid of the design paper, Fig. 111, viz. The cylinder is turned round until the division 1 of the tape *t t*, (Fig. 113) around its circumference is brought to an index mark, which is made on any suitable part of the fixed frame for that purpose, and the cylinder is fastened there by means of a stop *x*, Fig. 112, which is jointed to the fixed frame at one end, and the other end formed with a sharp hooked point to stick into the wood of the cylinder. This being done, the printer refers to the design paper, Fig. 111, and finding that the four first sets of yarns at the border of the warp do not require to be party-coloured, he proceeds to the number 5 along the top margin thereof, and finds thereby that the

six yarns which he is going to colour will be the fifth set in the intended warp, reckoning from the border of the warp, then proceed ing downwards under that number 5, he finds the first coloured square in the pattern is number 22 down the margin, and also that the said square 22 is painted green, therefore, he knows he is to take a printing ruler furnished with green colour, and laying that ruler upon the shelf F, he presses it towards the cylinder and makes the first impression across the yarns upon the cylinder. He then turns the cylinder round to division 23, and looking to square number 23 down the margin of his design paper, (still under number 5 at top,) he finds that square to be also green, and therefore he knows that he is to make another impression with the same printing stick, after refurnishing it with green colour; after which he turns the cylinder round to division 24, and by reference to his design paper, he finds it again to indicate another impression of green colour, and after that another repetition thereof, at division 25.

These four being done, he finds by referring to his design paper and proceeding downwards (still under number 5 at top) that no more party-colours are required on the fifth set of yarns until the 48th square, which is a light blue colour; therefore, he turns the cylinder round, forward as far as its 48th division, and fastening it there makes an impression with a ruler furnished with a light blue colour, which being done, another reference to his design paper shows him, that he must again turn the cylinder forward to its 53d division, and there apply an impression in dark blue colour; and, lastly, that he must again turn the cylinder forward to its 58th division, and there apply a green impression; after which the said fifth set of yarns, then wound on the cylinder, will be completed and rendered party-coloured at every part of their length where the pattern requires them to be so coloured, unless the cylinder is so large as to require the pattern to be repeated twice or thrice in going round it, in which case he repeats the operation accordingly. And, note, if the yarns have not been previously dyed, as hereinbefore mentioned, with an uniform colour, proper for the intended ground on which the pattern is to be represented, then, (unless the ground is to be white,) the ground colour must be applied to the yarns by making successive impressions thereon with a printing ruler furnished with the said ground colour, making such an impression whenever the cylinder is detained at one of its divisions, whereof the number corresponds to the number of the squares in the pattern paper, (beneath number 5 at top,) which squares are there filled with the said ground colour, viz., the squares numbered

1 to 21, in Fig 111, and then the squares numbered 26 to 47, and 49 to 52, 54 to 57, and 59 to 72. And, note, when the design paper indicates that impressions of the same colour are to be repeated in succession, those repetitions may be expedited by using printing rulers of double or treble the usual breadth of one division on the circumference of the cylinder. The fifth set of yarns (consisting, in this instance, of 6 yarns in number) being now rendered party-coloured, the moveable portions H H of the circumference of the cylinder are folded inwards, in the manner represented in Figs. 114 and 115, and as before described, in order to slacken and set the yarns loose thereon; and then the oiled cloth cover with the yarns upon it is removed from the circumference of the cylinder, which is immediately put together again, and another clean oil cloth is applied thereon, in readiness, for receiving the next set of yarns which are to be rendered party-coloured, according to the order of succession which is indicated by tracing the design paper Fig. 111, from the square numbered 6 at top downwards through all the squares beneath the same. Each set of yarns which is removed from the cylinder along with the oil cloth covering thereof, as before mentioned, is kept extended over two sticks until the colours become dry, and then the yarns are made up into a large hank or bundle, and submitted to steam by the usual process of steam printing, in order to fix the colours, and the yarns are then washed in water, to remove the gum or paste with which the colours were mixed up, and after being dried, the yarns are wound off upon bobbins in readiness for forming them into a warp for the loom. In forming which warp, each set of party-coloured yarns must take their proper place in the breadth of the warp for which they were originally intended when they were coloured with the succession of colours which is indicated by the design paper. In forming the warp by drawing off the yarns from the said bobbins, it may either be beamed on the yarn roller of the loom, or the yarns may proceed at once from their bobbins to the loom, to be drawn off there-from, as fast as the operation of weaving requires.

Respecting the weaving of figured fabrics out of yarns which have been rendered party coloured, suitably for that purpose, by Whytock's method, hereinbefore described, it is only necessary to remark, that the loom may be such as is commonly used for plain weaving, without any of the apparatus required for figure weaving, and the manipulations may be the same as those for plain weaving of the like fabrics to those on which it is intended to produce figured patterns by using party coloured yarns. And, on this head,

it only remains to explain a precautionary measure which is used during the progress of the weaving, to ensure that all the several yarns of the warp shall preserve their proper relative positions in the direction of their length, without any alteration thereof, during the weaving, from one end of the piece to the other, viz. In applying the colour to each set of yarns, either the first or the last of the impressions, which is made, when the cylinder stands at its division 1, must be of such a decided character, that its place on every yarn can always be distinguished with certainty; or, a narrow black impression may be made across every set of the yarns when the cylinder stands at its division 1, as a common starting place for all the yarns, and for all the sets of yarns; which decided impression, or narrow black impression, in consequence of the circumvolutions which the yarns make around the cylinder, will be repeated at every place along the length of each yarn, where the repetitions of the pattern are intended to begin and to end. In short, when the party coloured yarns are afterwards formed into a warp, the said marks will indicate the junctions of the successive repetitions of the pattern; and if the yarns are all adjusted so that those marks on each yarn will range in a straight line, square across the breadth of the warp, then a correct pattern will be formed by the party colours of the yarns; and all the precaution that is required during the progress of the weaving, is to keep all the yarns so adjusted in length, that all others of the said marks, at every succeeding repetition of the pattern, shall continue to range in straight lines, and square across. To ensure this condition a clamp, similar to that represented in Fig. 110 is used, which is composed of two straight rulers W X, united by screws v, v, which draw the edges of the two rulers W X together, and their adjacent edges are covered with cloth. This clamp is applied across the warp, with one of its rulers above the yarns and the other below them, near to the place where the said marks must range in a straight line, square across the warp, and there the clamp is fastened by its screws v, v, so as to hold all the yarns fast between the edges of its two rulers W X, in order to confine them to their relative positions end ways in respect to each other. As the weaving proceeds, the clamp Fig. 110 advances along with the yarn; and when the length of the pattern has been woven, the weaving must be suspended, whilst the screws v, v, of the clamp are loosened, to set it free on the yarns, and it is then taken back along with them, to the next succeeding marks; and, if those marks do not range in a straight line, and square across the warp as they ought to do,

those yarns which are too forward must be pulled back or stretched until the marks are made to range, and then the clamp is to be again screwed fast on the yarns, to confine them in their true relative positions, whilst another length of pattern is woven; after which the clamp is again shifted to the next succeeding set of marks and so on until the weaving of the whole piece is completed. This method of working with the clamp Fig. 110 during the progress of the weaving, is only requisite in case the yarns are drawn off at once from the bobbins to form the warp in the loom as the weaving goes on, without using a yarn beam to the loom: but, if the warp is formed and gathered on a yarn beam by a previous operation to the weaving, then the clamp Fig. 110 must be used in the manner above described during the operation of beaming, but it will not be afterwards required during the weaving of the warp which has been so formed from the yarn beam.

Note. It has been, by way of example, stated that the design, Fig. 111, contains 72 squares in length, and that the circumference of the cylinder is to be divided also into 72 parts; but this supposes a pattern of small extent, and a small cylinder. A large pattern would require a large cylinder, but on a large cylinder a small pattern might be repeated two, three, or more times. The cylinders which the inventor uses in rendering yarns party coloured for a velvet pile carpet, are 6 yards in circumference; but he finds it preferable to divide the circumference into 144 parts, and then 144 successive impressions of the printing rulers will be required to go all round the circumference: in which case a small pattern of 72 squares in length, like that in Fig. 111, would require to be repeated twice over, in applying the party colours to each set of the yarns, after the manner hereinbefore described, before the impressions would reach all round the circumference of the cylinder. Note also, that the operation hereinbefore described, of rendering the yarns party coloured, may be expedited in case the pattern is of such a nature that it will admit of being divided or split down by a central line, along the middle of the breadth of the piece, into halves, and that the pattern on each of those two halves will be precisely similar side by side, except being the reverse one to the other, as the pattern would be to its reflection in a looking glass. In such case twice as many yarns may be applied at once upon the cylinder, as would be applied for a single pattern, in the manner hereinbefore described, the width of the cylinder being suitably proportioned; and after the double set of yarns have been rendered party coloured, one half of them is taken in the operation of warp-

ing and weaving to the left hand of the centre of the breadth of the warp, and the other to the right; and in like manner for patterns which are to repeat three or more times side by side in the breadth of the intended fabric. For instance, if the fabric which is to be woven to exhibit the pattern, Fig. 111, be made double the width hereinbefore supposed, in order to contain two figured patterns, such as Fig. 111, but reversed to each other, and disposed side by side in the breadth of the fabric, then, the warp for such a fabric would contain 86 sets of yarns of 6 each. 516 yarns in the whole warp. In this case a double set containing 12 yarns may be wound on the cylinder at once, in order that all those 12 yarns may be coloured together, and after being so coloured and finished ready for forming into a warp, the 12 yarns are to be separated into 2 sets of 6 yarns each, and one of those sets is used for the right hand half breadth of the piece, and the other set for the left hand breadth thereof. But whether the whole pattern be repeated in reverse or not, any repetition side by side which continues through all the length of the pattern will afford the opportunity of colouring an increased number of threads at once.

The colouring will in all cases be better performed when the coils of yarns around the circumference of the cylinder are laid close side by side, without either crowding each other or leaving intervals between the yarns; therefore, the pulley *e*, on the end of the screw *d d*, (see Fig. 106) should be properly adapted to the size of the large pulley *g*, (see Fig. 112) on the end of the axis D of the cylinder A A, according to the fineness of the threads of the screw *d d*, in order that the screw may be turned with such a speed in respect to the speed of the cylinder, that the screw will carry the conductor G G (see Figs. 107, 108, and 109) across the width of the cylinder, or any portion thereof, at a proper rate of progress to lay the successive convolutions of the yarns properly side by side around the circumference of the cylinder; therefore, when a coarser sort of yarns are to be wound on, a smaller pulley *e*, must be applied on the screw *d d*, to turn it quicker, and give the conductor G G a more rapid progression; and, vice versa, when a finer sort of yarns are to be wound on, a larger pulley *e*, must be fixed on the end of the screw to turn it slower.* The number of yarns to be wound about the cylinder at once varies, for the reasons herein before stated, and also

* The pulleys *e*, and *g*, being on the same range in Fig. 113, would appear to constitute only one pulley; but the reader, on referring to Fig. 112 will easily understand their relative positions.

the number of convolutions of each yarn around the cylinder varies according to the size of the cylinder, and to the length of the yarns to be wound around it: it is necessary to adapt the machinery to those changes, for which purpose the wire eyes *z*, which are stuck into the two wooden rails R S of the conductor G G, (see Figs. 106, 107 and 108) and the loops *m m*, which guide the yarns, may be very numerous in a row, and the yarns may be conducted through those eyes which suit best.

In order to preserve as much as possible the form and regularity of the several coils made by each yarn and set of yarns, around the cylinder, after they are taken off therefrom, and during the processes of steaming and washing them, as aforesaid, it is proper to pass a small cord of worsted amongst the convolutions, under and over them alternately, tying its ends together. This interlacing of a cord across the several coils may be applied at two different places of each set of coils, before they are taken off from the cylinder, and it will facilitate the winding afterwards upon bobbins, as it will preserve the yarns from entanglement.

In rendering the yarns party-coloured for Turkey carpets, they must be coloured by the same method herein before described, but with the order of succession of colours according to the horizontal rows of squares across the design paper, instead of according to the perpendicular rows of squares thereon; because the figures or patterns on Turkey carpets are not formed as in the other fabrics herein before mentioned, by gathering up the warp threads, but by looping and knotting in detached tufts upon the ground warp. In the ordinary mode of fabricating such carpets, different individuals are generally employed on one piece of carpet, each of them having certain portions allotted to him, and which he is to fill with tufts. In using the party-coloured yarns for these tufts, the portions given to each of the workers must be coloured, so as to correspond to the part of the figure he is to work, or if the yarn has been coloured for a very extensive pattern, each long yarn might be divided into equal portions, and distributed amongst the number of hands to be employed, whereby there would be less risk of mistakes than in the ordinary method: the tuft with which one person would leave off would answer to the commencing colour of the next portion.

Having explained and set forth, by suitable drawings and description, the nature and objects of Mr. Whytock's invention and the manner of carrying the same into effect, we shall now proceed to describe some alterations made upon it by a relation of ours, Mr. Edward Henshall, carpet manufacturer, Huddersfield, England.

The reader will, indeed, perceive, that Whytock's description covers most of the ground claimed by Henshall, but, nevertheless, there are some features of novelty or difference in the latter individual's arrangements worthy of attention ; and from this consideration we have been led to make proper drawings* of his machinery while in *actual* operation ; in which undertaking we have been at much trouble and expense ; however, we will not grudge all that we have thus sacrificed, if by any means the machinery and processes of Whytock and Henshall shall be so amalgamated as to enable some of our brethren to supersede the present tedious system of manufacturing carpets. If even 25 or 30 yards of Brussels, velvet pile, or the Whytock carpet could be woven in one power loom per day, of 10 working hours, we think the old method might then be considered as on the high road to Texas ; and after its disappearance from all civilized society, the parties who survived the grand catastrophe (particularly if high-tarif-men) would, no doubt, make magnificent fortunes.

Henshall's improvements in manufacturing carpets, and hearth rugs, consist, Firstly.—In the application and use of a peculiar and novel arrangement of apparatus, designed for the purpose of winding the threads of yarns which are to constitute the warp thread of Brussels, Wilton, velvet, or velvet piled, or other similar carpets and hearth-rugs, from separate hanks of yarn, and laying two three, or more threads, side by side, as if in tapes or bands upon one bobbin, and thus preparing the threads for a two or three-thread warp, before they are placed in the loom for weaving, (same as in Whytock's.)

Secondly.—The invention consists in an improved construction of apparatus, and a novel mode of operation, as well as the peculiar arrangement of the yarns which are to constitute warp threads whereby, spots, squares, or stripes, may be printed upon a flat surface or table, by means of an ordinary block or type printing apparatus, in different colours, across a collection or number of yarns threads so arranged, that they may, after being so printed upon the table, be wound again upon a reel into hanks, and taken off the reel, and removed to be steamed, washed, and dried, in order to clear, raise, or fix the colours, as in the ordinary process of printing woollen yarns.

It must be observed, that each spot, square, or stripe, may be printed or stamped of any breadth of the block, or length of the threads or yarns, according to the pattern required, as the portion

* This we did in August 1840.

of the yarn so printed or stamped is intended to form one or more loops of the fabric, when thrown up by the weaving; that is to say, if two or more loops, in succession, are required to be of the same colour, to form the pattern of the carpet, the threads or yarns must be printed or coloured at once, over a sufficient space of the length, to form these two or more loops; this may be done with a block or type of the required breadth or length for two or more loops in the cloth, hereafter more particularly explained. (See Fig. 111 and its explanation.)

The object of this part of the invention, is to operate upon a greater number of threads or yarns, and produce the printed, or stamped, spotted, or striped yarns, direct from the bobbins; and after printing or colouring, to wind them at once direct from the printing table into separate hanks, all of which is done at one operation. These warps, when subsequently arranged, form the warps of as many carpets, or hearth-rugs, in contra-distinction to printing, stamping, or colouring the yarns collectively, when arranged in the form of a warp, with a pattern or device complete upon the surface of such warp, and ready to be woven in the loom, as hitherto practised under the patented inventions of Messrs. Woodcroft, Schwabe, Whytock, and Whytock and Clink; the first two persons printing or dyeing the intended pattern or device complete upon the perfect or arranged warp, either before or after beaming; and the latter, either printing on yarns, wound on a cylinder, or producing the colours by dyeing the said yarns.

When the threads or yarns have been so printed, they are properly arranged, as hereafter described, in order to form the warp threads of the carpets and hearth-rugs; they are then woven in an ordinary carpet loom. This part of the invention also comprises the arrangement of the threads, and apparatus connected therewith.

Thirdly.—These alterations on Whytock's plans consist of an arrangement of machinery, by means of which, the warp, yarn, or threads, or warp throughout its whole length, can be woven into a slight gauze-work, having weft threads put in at distances of about an inch asunder; and this is done during the operation of beaming the warp direct from the bobbins.

After the warp-yarn has been thus prepared, patterns or designs may be printed upon its surface, in the ordinary manner of block printing.

In printing the gauze, the pattern-blocks must be elongated when intended for Brussels or similar carpets or hearth-rugs, as before named; and this is accomplished by providing the block, upon

which the pattern is wrought, about three-fifths longer than th
finished pattern will require, when the cloth is completed, as th
operation of weaving will weave, or loop up, the extra three-fifth
of printed gauze. The gauze, when printed, is removed to b
steamed, washed, and dried, in the ordinary manner of woolle
printing; after which, it is re-beamed, and woven in an ordinar
plain carpet loom, the preparatory weft threads of the gauze, bein
removed as the cloth is woven.

Fourthly.—The improvements consist in weaving, in a commo
simple loom, Brussels or similar carpets, or looped fabrics, as Wi
ton or velvet piled carpets and hearth-rugs, plain, either in white c
grey yarn, or any colour, intended as the ground of the pattern
and afterwards printing upon the said plain goods, any pattern c
device, in the ordinary manner of block or machine printing, th
colour parts of which may be raised, washed, and dried in the usua
way. The carpet is then distended, and the back stiffened wit
size or other suitable matter, as may be found requisite.

Fig 116

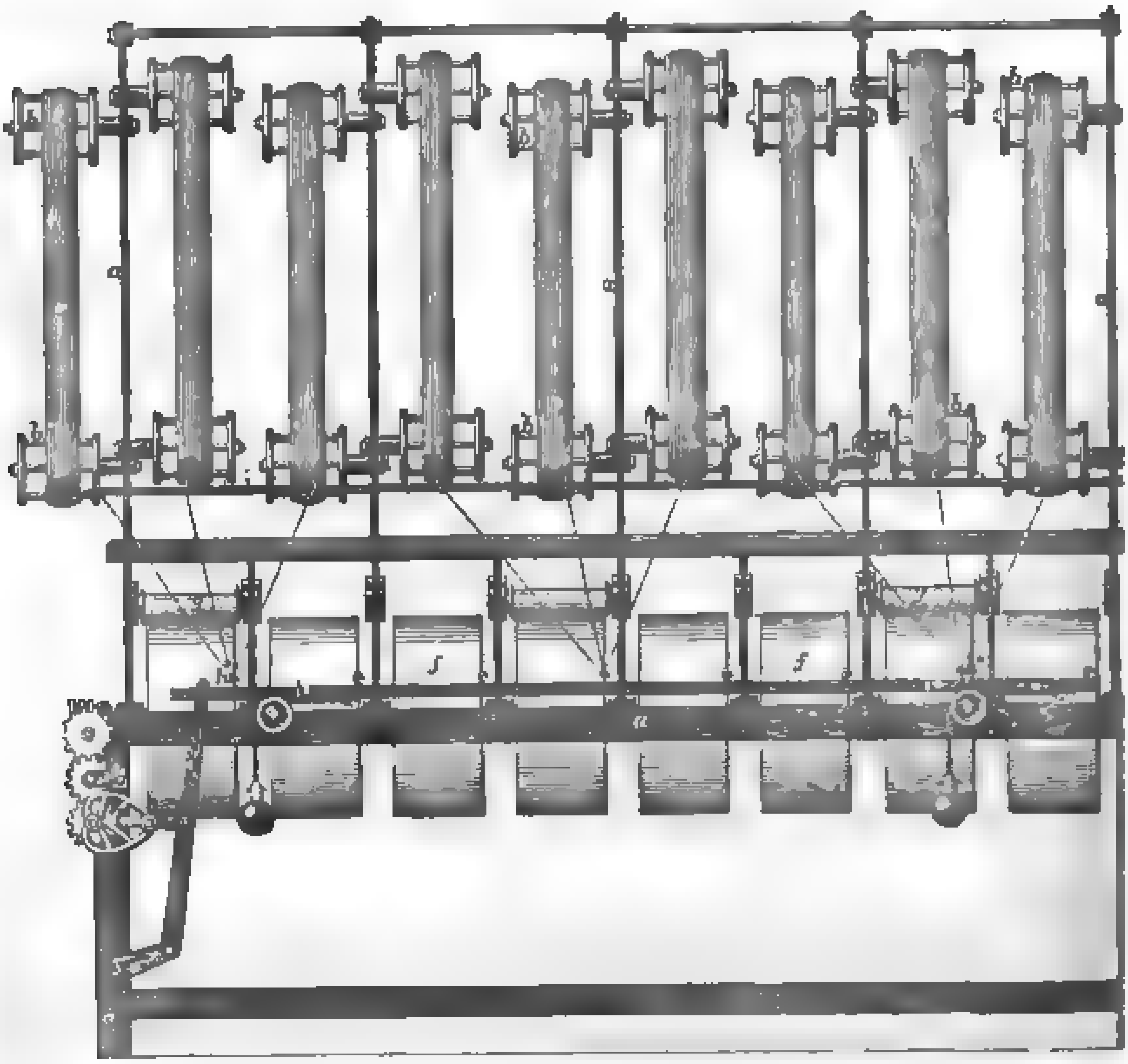


Fig 117

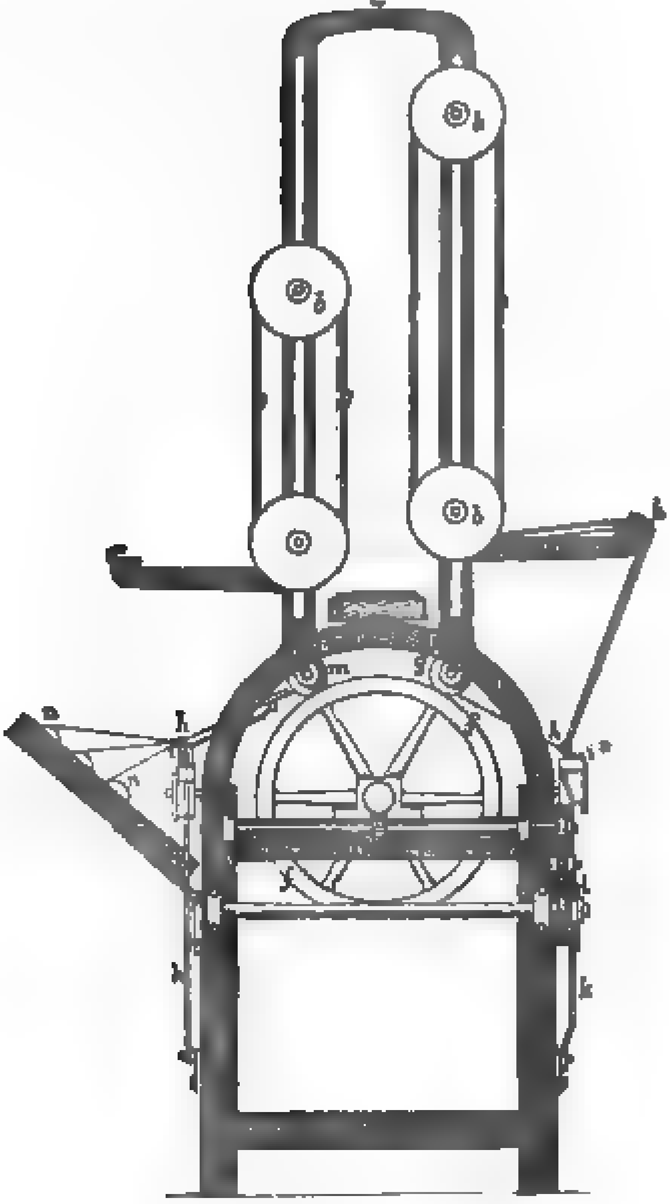


Fig. 116 represents a front elevation of an improved winding apparatus, constituting the first part of the improvements; Fig. 117 is an end view; and Fig. 118 is a plan or horizontal view of the same, as seen from above. These Figs. will be sufficient to illustrate two methods of carrying this part of the invention into effect, viz. doubling from hanks, or skeins, or separate bobbins, as one side of the frame is represented having the hanks or skeins, and the other the bobbins.

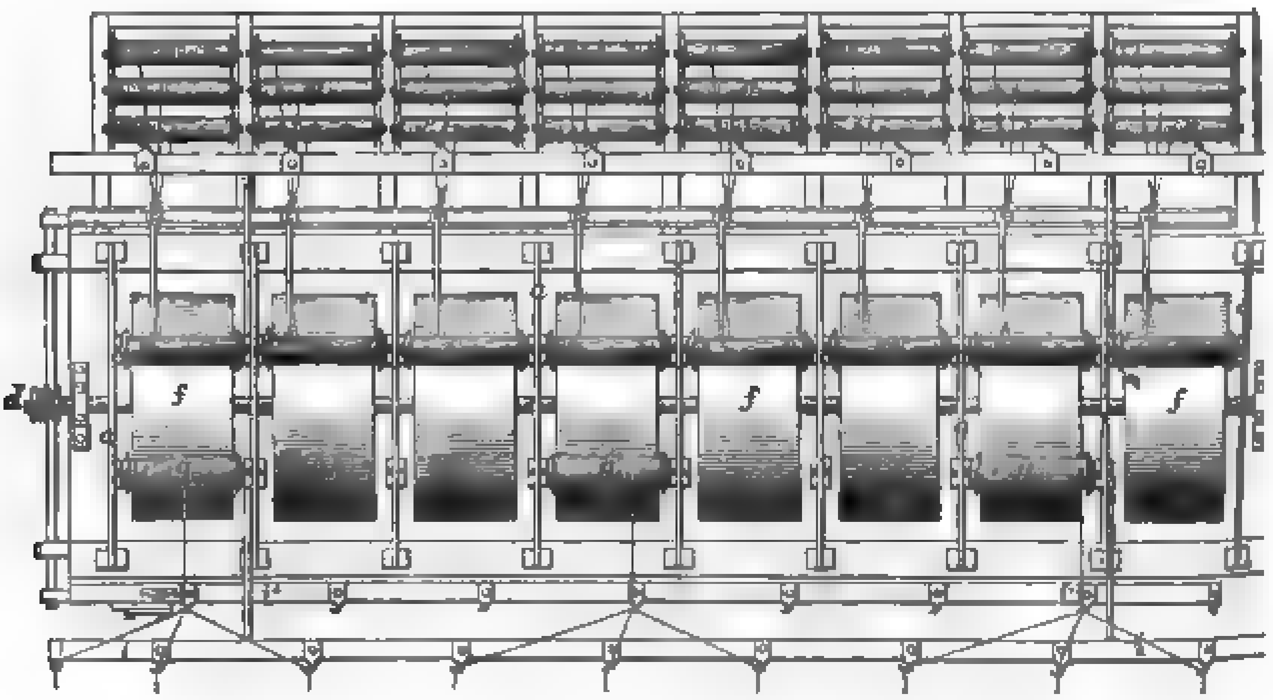
The machine consists of a slight frame *a*, *a*, *a*, the upper part of which supports the reels *b*, *b*, *b*, (see Figs. 116 and 117) containing the hanks of yarn *c*, *c*, *c*. The lower part of the framing supports the driving shaft *d*, *d*, (see Figs. 116 and 118) upon which is keyed the pulley e^1, to which driving power is to be applied. Upon this shaft *d*, a series of wooden drums *f*, *f*, *f*, are also mounted, which revolve with it, and drive, by friction of contact, the bobbins *g*, *g*, and *m*, *m*.

The yarns or threads being taken separately from the han c, c, c, two, three, or more of them are brought together, and pass through the eyes h, in the stationary guide-rail i, i; thence throu the eyes or hooks h^*, h^*, on the traversing guide-rail i^*, i^*, (see Fi 116 and 117.) These threads are then wound upon one of t bobbins g, side by side, so that the two, three, or more, will readi unwind from the bobbins, at the same speed, and thus always p serve an uniformity, in length and tension.

The guide-rails i^*, are traversed to and fro, in order to lay t yarn evenly upon the surfaces of the bobbins, by means of the lev k, being moved by the heart or excentric motion l, (see Figs. 1 and 117) geared with the other end of the driving shaft.

It will be observed, by the drawing, that a similar arrangeme is represented upon the other side of the machine, except that t three threads are being wound together upon the bobbin m, from bobbins n, n, (see Figs. 117 and 118) instead of the reels b, b, hanks c, c, c.

Fig.118



The apparatus necessary to perform the second part of the im provements, namely, the arranging, printing, or stamping, and reel ing of the threads or yarns, intended to be woven into carpets o rugs, is shewn in longitudinal elevation at Fig. 119.

Any number of bobbins containing the yarns, are placed at a^1, a^1, upon spindles mounted (either vertically or in any other manner) in the boards b^2, as a creel, the yarns from which are passed between the friction guide rollers c^*, c^*, and one, two, or more threads (ac-

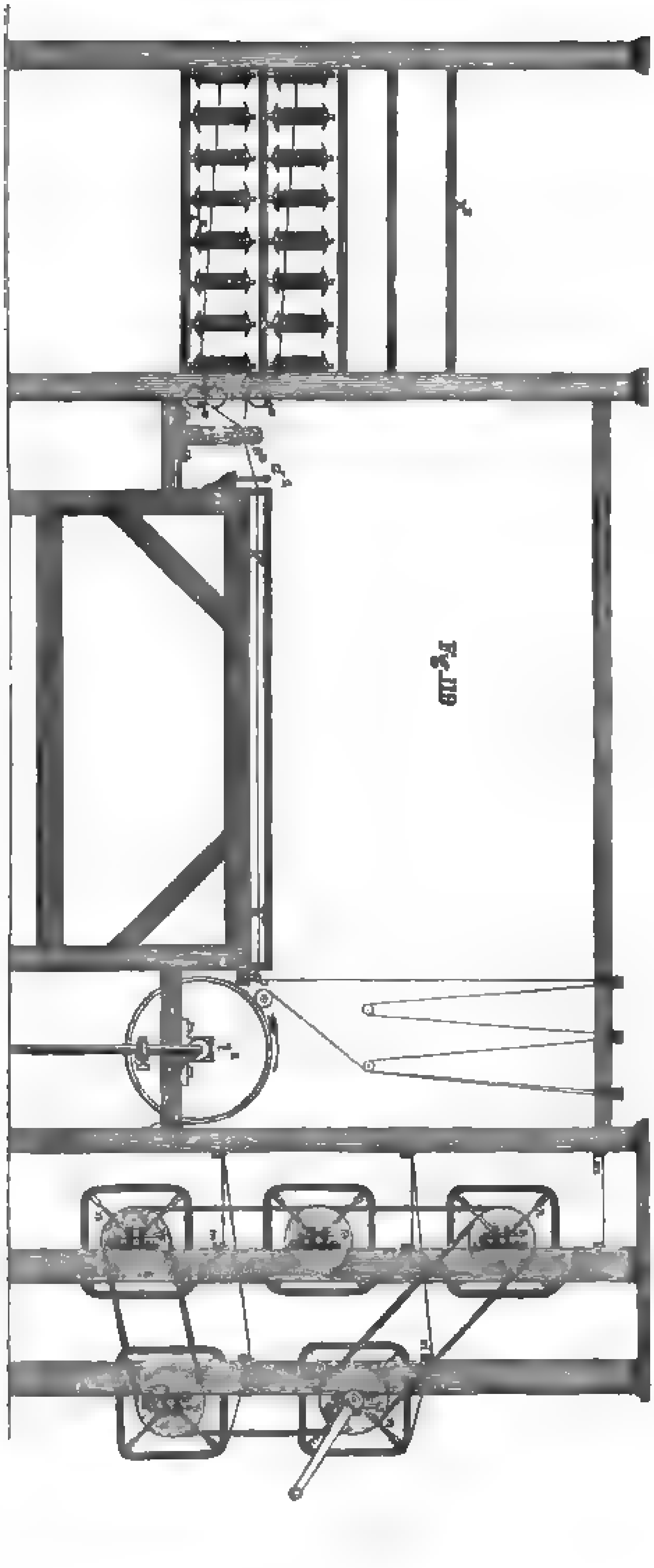


Fig. 119

cording to the quality of the carpet required) are drawn throu each space of the wires in the sley or reed *e*; say ten or twenty such threads are passed through the reed, side by side, and forn band; a space or blank, of about the same width as the band yarns, is then left in the reed; and again, a similar number threads and spaces are left alternately, until the reed is filled. T ends of all the threads are then to be confined in a nipper or cl g^1, and drawn tightly across the printing or stamping table h^2. T operation of ordinary block-printing or stamping, is now to be p formed, which must be governed by the pattern paper, as in or nary figure weaving; spots, stripes, or squares, only, are to be print or stamped, and not any regular fancy pattern or device.

It will be necessary to have an ordinary squared or plaid patte paper, every square or plaid of which corresponds with each two three threads of the intended carpet, as in Fig. 111; and after t pattern, to be produced, has been carefully coloured upon the desi or ruled paper, by examining the paper, the workman or prin must be governed or directed in printing or colouring the yarn.

Small blocks or types, the breadth of the band of threads, and length required for one, two, or more loops of the carpet, wh woven, must be provided, according as the pattern paper directs, a screwed up into a small hand block, like those used for mark i shirts;—thus, if the pattern directs one loop should be printed stamped black, one type or block must be placed to print or sta it, and then the number of blanks and printing types which foll are added, until one hand block of a convenient length, is form the whole being screwed together; or a single block may be us taking one or more colours from a party-coloured sieve, at the sa dip, and applying it direct to the yarns.

When the entire bands or lengths of the warp threads have b printed or stamped, as they are passed over the table, they must each distinguished by a number or letter.* After the length threads, lying at one time upon the surface of the table h^2, h^2, F 119, has been printed or stamped, the nipper or clasp g^1, is to closed on to the threads which pass over the table h^2, h^2, in orde remove the length just printed and allow another length of the ya to be drawn over the printing table.

The printed or stamped threads are hung upon wooden rolle to partially dry (as shown in Fig. 119) and are afterwards co pletely dried, by passing over the heated cylinder l^1; thence the

* Instead of the waymarks or hieroglyphics used by Whytock.

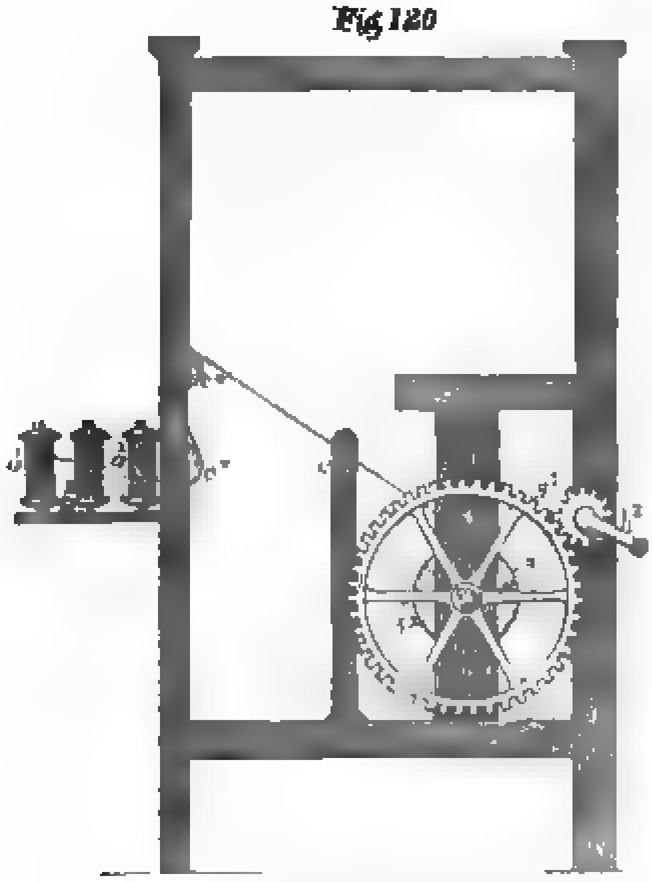
proceed over guide rails *m*, and being there separated by upright wires, are wound into hanks upon the reels *n n*.

The hanks must also be carefully numbered, when taken off the reels, each hank forming only one warp thread, the entire length of the piece,—the same numbers being of course employed, as previously marked in the printing; they may then be steamed, washed and dried, or otherwise treated, as in woollen printing.

When these hanks are required to form the warp threads of carpets or rugs, they are to be wound again upon bobbins, which are numbered the same as the hanks. The bobbins should then be taken in their numbered order, and in sufficient quantities to make a full warp, as we have already explained in the account of Whytock's carpet.

The bobbins *a a*, are now to be placed upon spindles and boards b^2, as just described, shown in Figs. 116, 117 and 120, beginning with thread No. 1, and passing it through the first space of the sley or reed *e*, and so on for the entire width; then the full warp is to be beamed on the roller f^2 f^2 for the loom (see Fig. 121) direct from the bobbins,—which being done, the beam of warp may be removed to a common plain cloth loom (like that shown in Fig. 120) to be woven.

Fig 120



Figs. 121 and 122 represent a plan and side view of a slight

temporary loom, in which the third part of these improvements is effected.

Fig 121

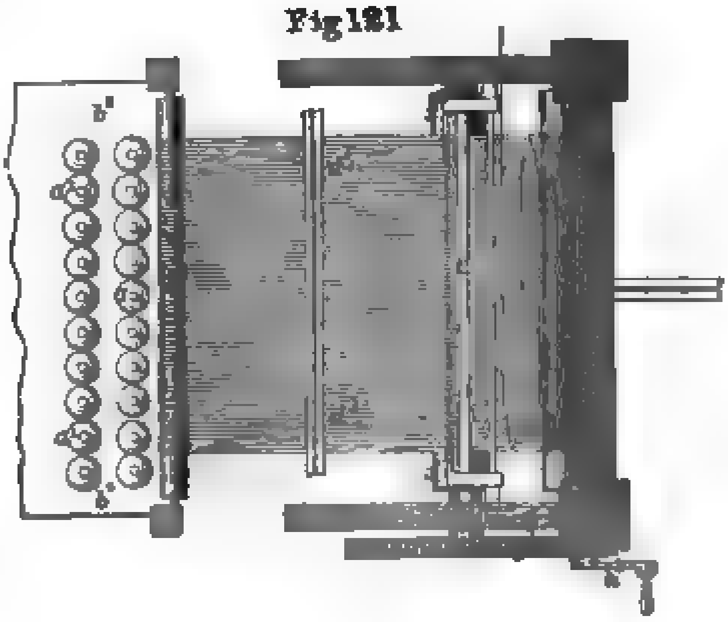
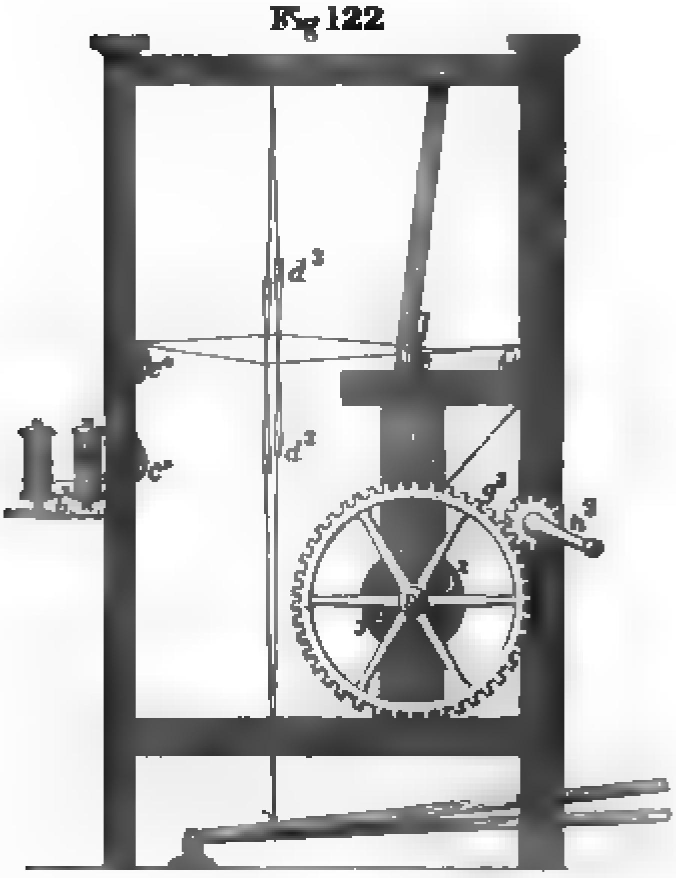


Fig 122



A similar creel of bobbins a^1 a^1 a^1 to those before described, are placed upon the boards and spindles b^2 b^2 and contain the warp threads, either single, double, or treble, according to the quality of the intended fabric; but, instead of beaming them at once for the loom, they are passed over guide or friction rollers c^2 c^2 through the headles d^2 d^2 and reed or sley e, (see Figs. 121 and 122) and at every inch or more of space, a weft thread o^2 is thrown, in order to convert the warp thread or yarns into a preparatory gauze-work,

ithout weaving any positive or permanent fabric or cloth; thus a ırtial weaving is effected with the temporary cross threads o^2, by eans of the headles d^2 d^2 and sley e; the gauze is then drawn r the beam f^2 f^2, by means of the tooth gearing g^2, and winch handle h^2, and is then ready for printing. (See Figs. 120 and 22.)

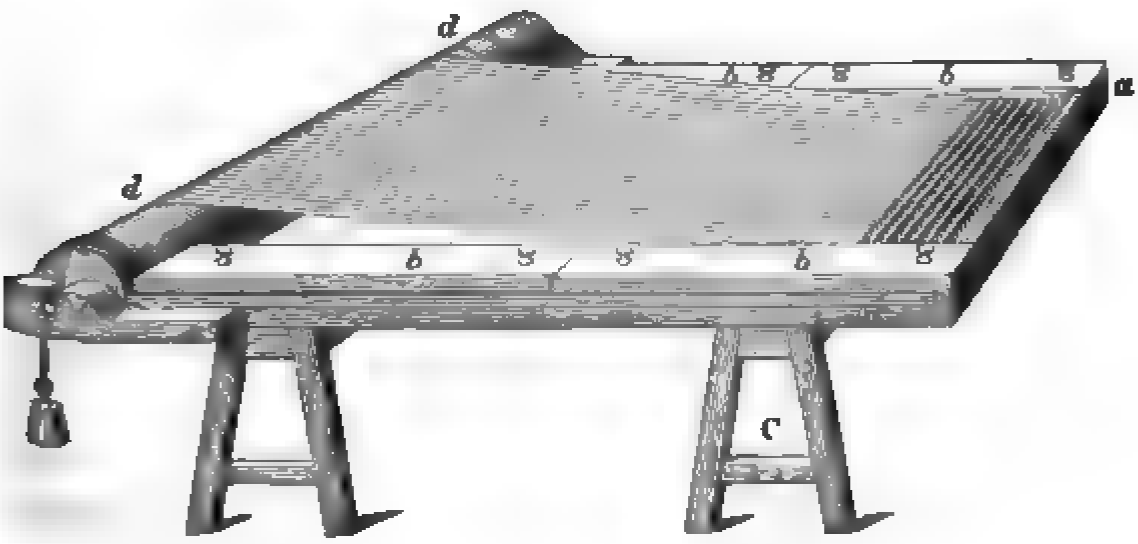
ANUFACTURE OF CARPETS, RUGS, &c., BY CEMENTING A NAP OR PILE ON PLAIN CLOTH.

A method of manufacturing carpets, hearth-rugs &c., has lately een discovered, which differs so much from those already described, nd at the same time possesses so much merit, that we think our Vork would be incomplete, without giving an account of it. This ıethod is, indeed, so unlike the ordinary modes of manufacturing arpets, hearth-rugs &c. that it cannot, properly speaking, be condered under the head of any branch of weaving at all; it will, owever, be interesting to both weavers and manufacturers, to have full explanation of it, as it is likely to supersede many of their esent processes.

This remarkable invention attracted considerable notice at the ne of its first introduction, in 1838; and several machines are w in operation, upon the principle of it, in England and Belgium. e have made the annexed drawings and description from a ıchine, while at work in the latter country; and hope that our rts may prove beneficial to many of our friends.

Fig. 123, represents a perspective view of a machine suitable for rying out the first part of the invention. a a, is a quadrangular me having the guides b, b, affixed by screws or other suitable ans, allowing of their being readily removed to take out the work.

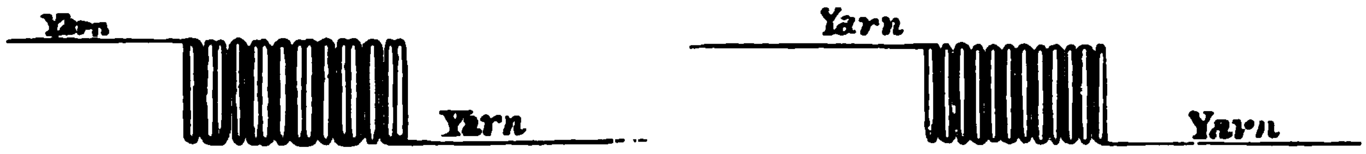
Fig. 123.



The frame *a*, *a*, is supported by the legs or frame *c*, *c*. On t
under side of each of the guides is a groove or space between t
guide and the frame *a*, the object of which will be hereafter fu
explained. *d*, *d*, is a roller or beam (see Figs. 123 and 125)
which is warped a number of yarns or threads of worsted, wc
cotton, silk, or other fibrous materials, or mixtures thereof, in li
manner to winding or beaming a warp for a loom, as if the sai
were to be woven into a fabric, in the ordinary way of weavi
with warp and weft, and the warp beam or roller *d*, *d*, is weigh
and has friction cords or bands, as is practised in looms for weavi
and as is shown in the drawing. The ends of the warp threa
are made fast to the front rail of the frame *a*, in like manner
fastening a warp to the cloth roller of a loom. The workman th
proceeds to work in the following manner; he has a number
strips of thin metal, such as copper, zinc, or other suitable ma
rial; the strips being all of the same size; and are to be in wic
what the depth of the desired nap is to be, and of a length son
what greater than the width of the fabric to be produced in the n
chine; the frame *a*, (see Fig. 123) and guides *b*, *b*, are to have a spa
between them equal to the width of the intended fabric to be p
duced. The workman first places one of the strips of metal un
the warp, and draws it up to the end, and parallel with the front r
of the frame *a*, the two ends of the strip being placed under the gui
b, *b*, by which they are prevented rising up; he then places t
next strip edgeways on the upper surface of the warp, and depres
the warp evenly between the first and second strip, and he sprin
or bends the second strip in such a manner as to allow of the t
ends thereof entering into the grooves formed between the guides
b, and the sides of the frame *a*. He then places another strip und
the warp, and raises the same up evenly between the second a
third strips, and he bends the strip in such a manner as to cau
the two ends to enter the grooves formed between the guides a
the sides of the frame *a*, and then straightens the strip so as to l
the same parallel with the preceding ones; then he takes a four
strip and places it on the upper surface of the warp, and depres
the threads thereof evenly between the third and fourth strips, a
causes the ends of the fourth strip to enter the grooves formed b
tween the guides *b*, *b*, and the frame *a*, and with a straight-edge l
presses the strips up evenly from time to time, so that they ma
each be kept upright on their edges and in straight lines parallel
each other, and when the frame *a*, *a*, is full, the yarns or threa
composing the warp will be so arranged between the strips of met

or other suitable material, as to pass first over, then under, each succeeding strip, as is shown in Fig. 124.

Fig. 124.



The warp thus arranged should have a smooth surface of metal or other suitable material passed over and pressed on the upper side in order to lay and press the yarns or threads down evenly, and also to cause them to spread out in such manner as to produce a touching of the fibres throughout, so that when a suitable cement shall be placed or spread thereon and dried, the whole will become one sheet of fabric when the strips are removed by cutting, as will be hereafter more fully explained. The cementing material used by the inventor is India-rubber (caoutchouc;) but other materials, such as shellac, may be employed instead. One or more coats of India-rubber, or other cement, is to be spread over the surface of the warp, arranged and prepared as above explained, and permitted to dry, and in this condition the frame *a*, *a*, may be turned over, and then, by a sharp knife or other suitable cutting instrument, the strips may be successively removed by cutting the yarn from side to side of the fabric, in like manner to cutting the warp when weaving velvet, or Wilton carpet; but it is not necessary to have the strips grooved, as is the case with the wires used in making velvet, but they may be grooved, if it is desired to be very correct in the cutting. The fabric thus prepared is then suitable to be applied to woven textures or other surfaces, by cementing it thereto, but it is preferable that the back of the woven fabric should be cemented on to the warp, immediately on the warp or pile having been heated with the cement, and before cutting out the strips of metal (as shown in Figs. 123 and 124) or other suitable material employed, and this may be performed by having first spread a layer of the cement on the warp, and another on to the fabric which is to constitute the back, and then bring the two cemented surfaces together and press them well; and if the surfaces be extensive the pressure may be conveniently performed by means of a smooth iron roller passed over the upper surface, such roller being made hollow, may be heated with an iron heater. In case it be required to make carpets, or rugs, or other fabrics, with patterns, then it will be desirable to print the yarns or threads in the warp, but each pattern in the printing must be so lengthened as to allow of the bending up of the

yarn, and the colours used must well penetrate the warp (see Whytock's and Henshall's methods.) Fig. 125

Fig. 125.

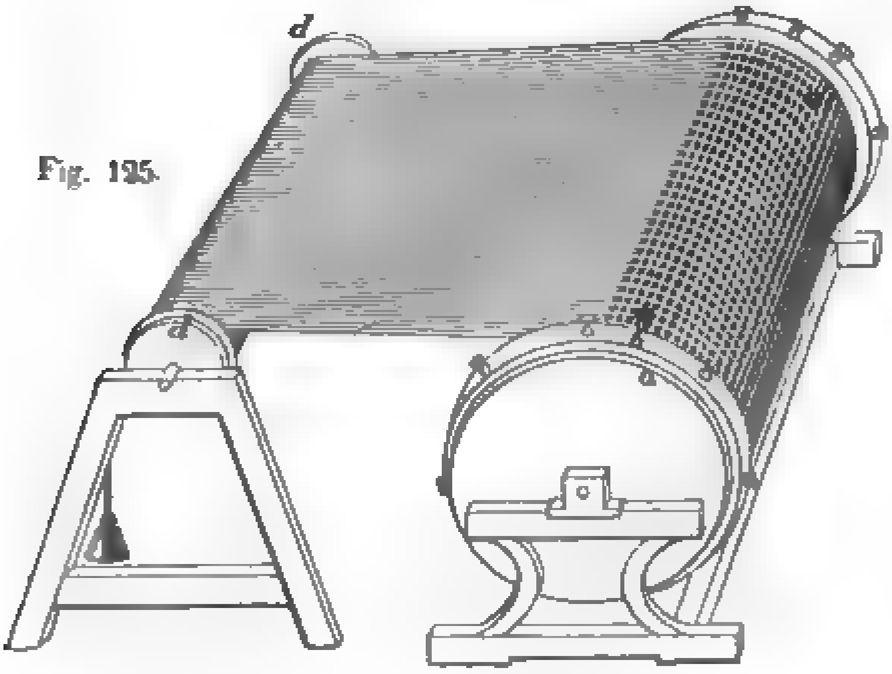
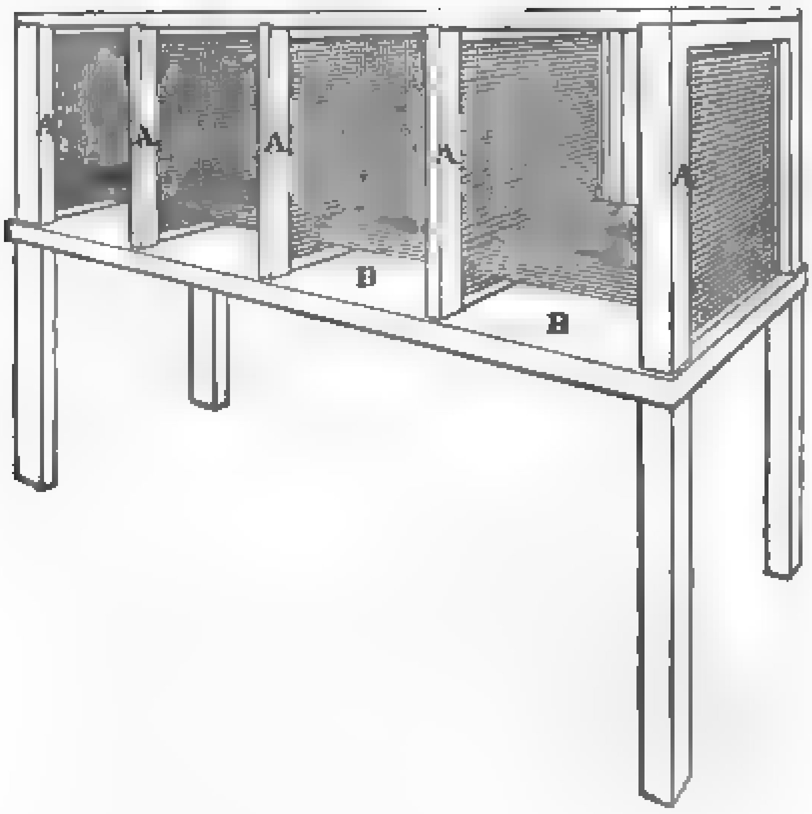


Fig. 126.

Fig. 127.



shows another arrangement of machinery for performing a like operation of bending lengths of threads or yarns to that above described; the only difference being that the frame *a*, and guides *b*, are formed into a cylinder, and this machine requires that the fabric when produced should be unwound before the cutting out of the

strips: in other respects the description above given, aided by the drawings, will be sufficient, the same letters indicating similar parts in this machine as were used in Fig. 123. And it will be seen that the cylinder *a, a*, has an axis with suitable bearings at each end, in order that it may be turned round by the workman as he proceeds with his work. Another means of performing this operation of bending a number of threads or yarns (in such manner that each portion of thread or yarn when cut shall be cemented at a point or part intermediate of its length, and the two ends thereof rise to the surface and form the warp of the fabric,) may be employed in the following manner; in place of warping the threads or yarns on a roller or beam, as above explained, and then bending the warp over and under a series of thin strips of metal, as in Figs. 123 and 124, the strips may have thread or yarn wound spirally around them, as is shown at Fig. 126, and then a number of such covered strips are to be packed side by side in a frame *a, a*, and the yarns or threads cemented together and to a suitable fabric, and the strips cut there-from as above explained. We have stated that the looped up threads or yarns were to be cemented to a cloth, which would serve as a back, yet under some circumstances it will be preferable not to perform that operation, such as in making a suitable napped fabric for the covering of hats and bonnets, in which case the napped fabric being made, as above explained, in place of cementing it to any fabric, it is to be cemented directly on to the hat or bonnet.

We will now proceed to describe the second part of the invention, which relates to another mode of manufacturing carpets, rugs, and other napped fabrics, which differs from that above described, but is capable of being so worked as to produce very ornamental surfaces and may be made to resemble tapestry and highly finished paintings, *depending on the taste of the person who works the pattern* as will be hereafter explained.

Fig. 127 represents a frame or apparatus suitable for working the pattern when performing the second part of the invention. A A A A are quadrangular frames affixed on the board B B. Over each of the end frames A, is evenly stretched canvas, such as is used for worsted work, in such manner that the canvas at each end shall be stretched to coincide one with the other as nearly as possible can be done. The person who works the pattern is to proceed as follows:—

By means of a needle he draws the worsted, wool, or other yarn or thread through a hole or mesh in the canvas at one end, and

through a corresponding hole in the canvas in the other frame A, commencing the work at the lower corner hole, and working successively through each hole of the lower rows of the surfaces of canvas; then the next above, (taking care that the thread or yarn between the frames A lie even and smooth, and are drawn equally tight) and the work is to be continued till the yarn has been passed through every hole, when there would be a long quadrangular mass of yarn or thread, which is to be encompassed with a box or case C, (see Fig. 128,) open at both ends; and having so encompassed and secured the mass of yarn or thread, the same may be cut away from the canvas or fabric, and a piston or rammer inserted into the box or case C, which, fitting closely on all sides, will, when desired, force out portions or lengths of the yarn, in order that the same may be cut off after it has been combined by cementing it into a fabric, as will be hereafter more fully described; and the ends of the fibres in the box C, against which the ram is to press, should be cemented to the ram and permitted to dry, before commencing to force out the mass of yarn by the ram.

Above we have given our readers an account of the mode of working without reference to the pattern; and we shall now proceed to show how a design or pattern may be worked in the frame, and subsequently transferred and subdivided into a multitude of surfaces, or portions of surfaces. We would first remark, however, that the canvas, or fabric used on the frames A should be fine or coarse, according to the degree of fineness of the yarn or thread used, whether of worsted, wool, cotton, silk, or other fibrous materials or mixtures thereof, and the pattern or design is to be worked or executed with the needle, by counting the meshes, and drawing through colours according to the order of the pattern set before the person performing this part of the work, drawing the thread or yarn through each of the frames, as has been above explained: or it may, in some patterns, be performed by marking the canvas. Thus, supposing that the pattern to be produced was a red jack-ass on a white ground, and that the shape of the ass was marked on the canvas, the person working would continue to draw white yarn or thread through the canvas so long as the lower part of the frame was to receive the ground, then with white and then with red, according as the portions of the row of meshes or holes, of the canvas across from side to side was ground or pattern, and so on till all the holes were worked through and the said quadruped completed. Having performed this operation, he would surround the warp of yarn or thread with the box or case C, as above explained, the boxes or cases C,

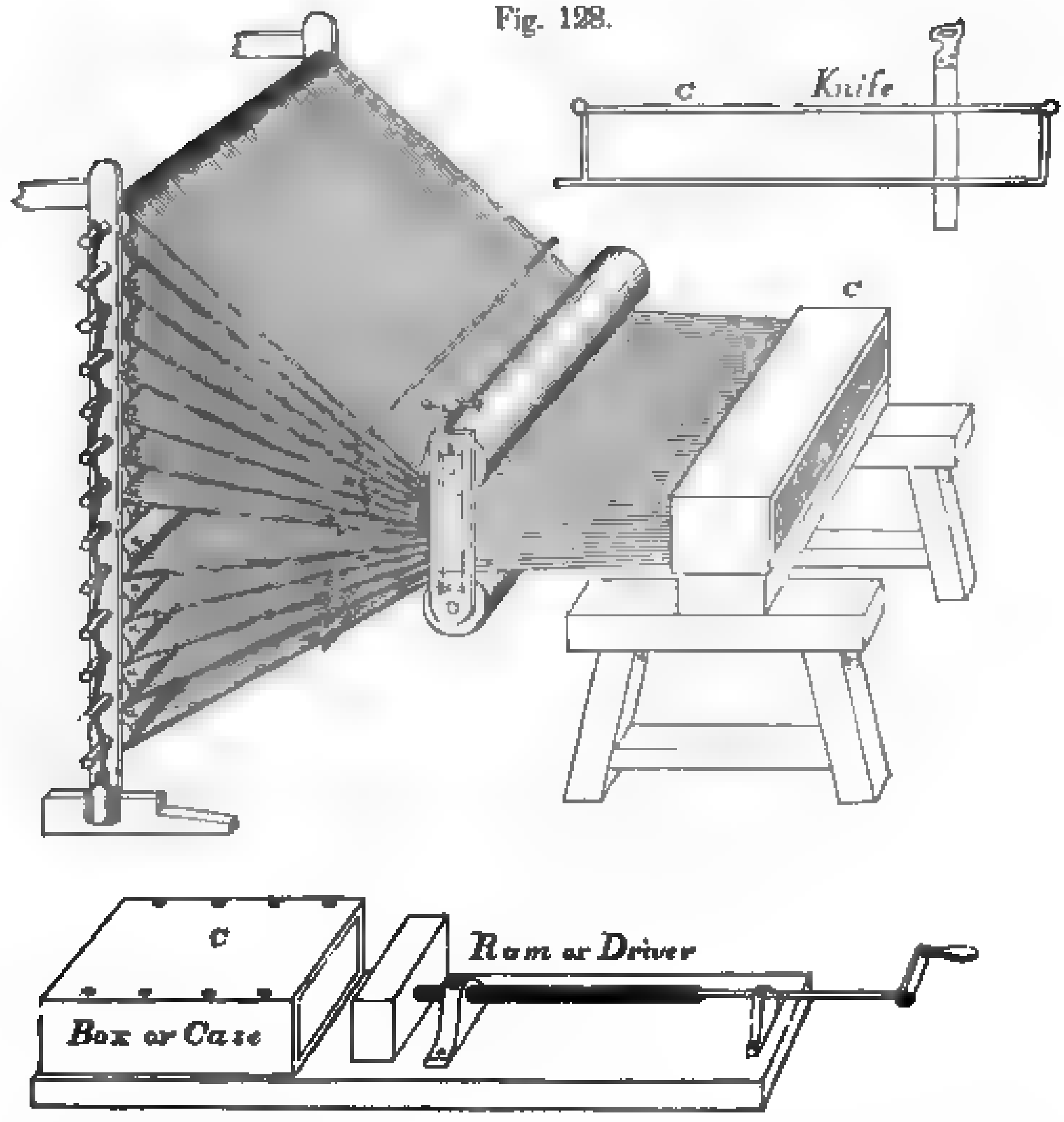
being formed in parts capable of being put together readily, by screws or otherwise. We have chosen this simple pattern in order to give a clear description of this part of the mode of working as practised by the ingenious inventor, but from the foregoing description a person will readily be able to perform other patterns, of varied degrees of intricacy, *depending on the taste of the design*, which should be drawn on paper such as is now used in working worsted work on canvas; that is, by having the colours in small equal-sized squares, as is well understood, and consequently forms no part of the present contrivance, and then, by counting the meshes or interstices of the fabric, draw in threads of the colour required, and as may be marked in the design paper. Or in some cases the pattern may be marked on the canvas or fabric, on the frame A A A A A (see Fig. 127.) When the frames are full a case C is applied, just sufficient to embrace the mass of threads or yarns, and retain the same closely together in such manner, that in forcing the mass of threads or yarns through the case in which they are included, they will be prevented getting out of the correct position. Hence each successive portion or slice cut off from the end of the case, will be a repetition of the same pattern, which being combined together will produce a carpet, or rug, or other napped fabric, depending on the nature of the fibrous materials employed, and the mode of getting up the same.

There are other methods by which masses of yarns or fibres may be obtained within cases or boxes C, and worked therefrom according to the invention. We will now explain two other modes, slightly differing from each other, and from the one above explained; but by both the object of this part of the invention may be obtained, whereby a mass of yarns, or threads, or such like combination of fibres may be produced in masses, in suitable cases or boxes, and allow of a succession of cuts or slices being successively taken therefrom, in order to produce successive surfaces, or portions of surfaces, which being cemented before cutting, will form the nap of fabrics.

Fig. 128 represents a perspective view of an apparatus or machine wherein a number of warp rollers *a*, *a*, *a*, each having wound thereon threads or yarns of any suitable fibre, according to the fabric desired to be produced, the warp rollers being equally weighted.

Each layer or warp of yarns is made fast to a rod, which keeps the layers of thread separate (as shown in the Fig.,) and correctly placed, one warp above the other; and having so obtained a mass of threads or yarns, the same is to be enclosed in a suitable case or box C, as above described. Such boxes or cases C, may be of any

Fig. 128.



convenient length, say twelve inches, *which is a convenient leng*-
and they may be successively cut from the body of warps, tak-
care that before cutting off one box or case, or more, securely
compass the body of yarns or threads, in order to hold them
curely, the cut or slice being made between the cases or boxes by
sharp thin knife, or such suitable razor-like instrument. Each
these boxes or cases C, will then be worked off by having suitab-
pistons placed, and forced through them, as above explained, or i-
cases where the length of nap will allow of it, the cases or boxes C,
may be made of parts, each only as deep as the intended nap.
Then, in order to cut off each successive layer or slice, India-rubber or other suitable cement should be evenly spread over the external ends of the body of warps. In order to cement all the ends together, a slice, and case or box C, may be cut off, starting with several such narrow cases, and applying one around the yarn as one is cut off, in order to retain the nap secure, the cases C being hinged or otherwise.

Fig. 129 shows another mode of obtaining a body of threads or

yarns into a box or case, in order to allow of a succession of slices or surfaces being cut off to form napped fabrics. It consists in what may be called a folding machine, whereby a warp of yarns or threads, either all of one colour, or of intermixed colours, *according to the will of the party*, and depending on the description of napped fabrics it is desired to produce.

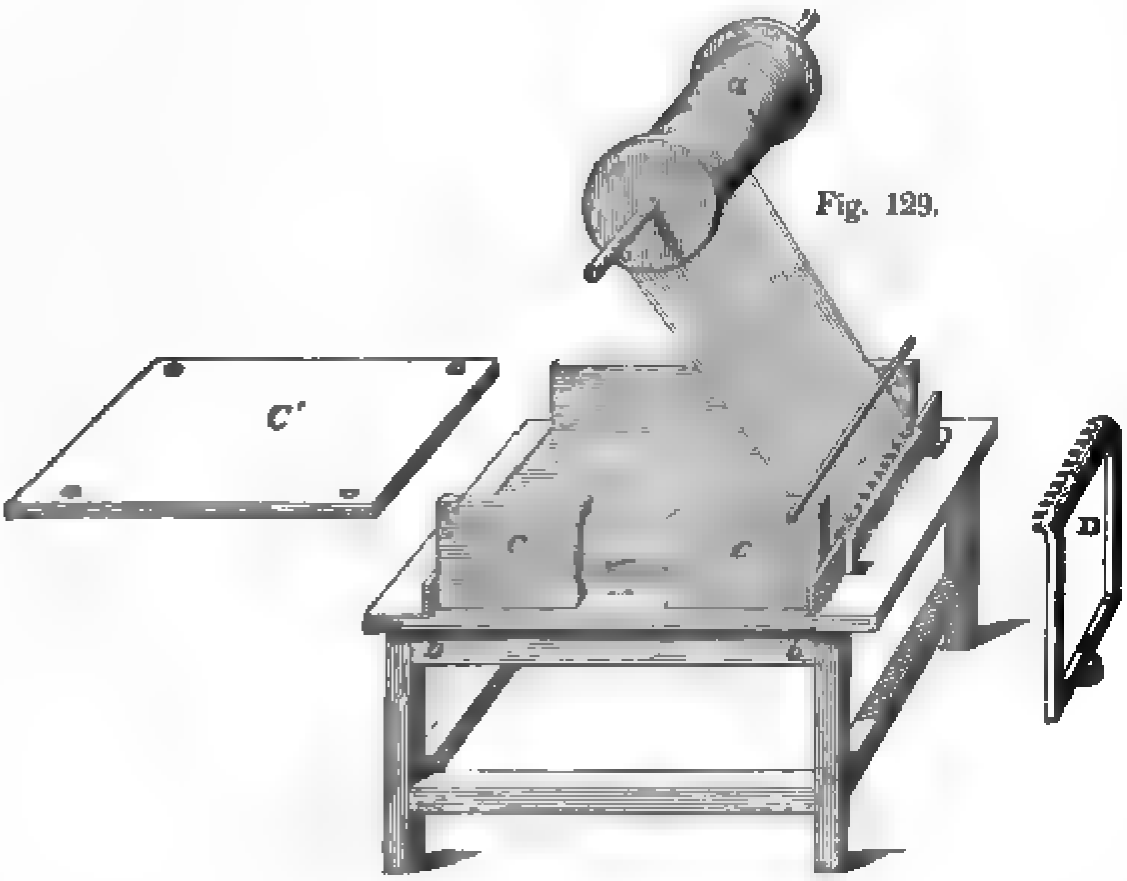


Fig. 129.

a, is a warp roller, on to which the threads or yarns are beamed. *b*, *b*, is a table; and *c*, part of a box or case in which it is desired to pack a quantity of threads or yarns, and C', is the top or cover of the case. The warp is made fast to a rod, which is at one end of the case C C; and is then drawn evenly to the opposite end of a case, and a rod or other suitable intrument is laid across the top of the warp; the warp is then taken evenly back to the other end of the case C C, and another rod laid on, and the warp again brought to the other end of the case and another rod laid on till the warp is folded, and the case is full, the rods being of such a length as to protrude beyond the end of the case C C, and in order to pack the whole closely, the rods are kept pressed down by the weighted instruments D, at each end of the box or case C C, and when a number of layers of the warp have been folded, the lower rods may be successively removed, in order to allow the layers to go more closely together, and by this means a body of threads will be packed in a case or box, from which may be cut a succession of slices, each slice forming the napped surface, or part of the napped surface of a fabric. We

have thus far spoken of the frames or cases into which the threads or yarns are packed as being rectangular, but we would remark, that they may be of other forms, depending on circumstances. By which arrangement, where an extensive surface is desired to be napped, the cases or boxes may be made into such forms as will, when combined together, produce the shapes required, and place the patterns, or parts of the pattern, in the proper place, which arrangement will allow of the patterns or ornamental designs (which require the most time in packing) being worked into separate boxes or cases, and the threads or yarns which are to form the ground may be in separate boxes or cases C.

Whatever be the course pursued in obtaining bodies of yarns or threads in boxes or cases, as above explained, the fibres at the end of which may protude, should be carefully shaved or cut off evenly, and India rubber, or other suitable cement, is to be laid on to the surface of fibres and permitted to dry sufficiently before the ram or piston is caused to force a quantity equal to the length of the desired nap from the case C. When sufficiently dry, and on examination the cement appears to be complete over the whole surface, the piston or ram is to force out of the case or box C, a length equal to the length of the nap; when that quantity is to be cut off with a sharp knife, or other suitable instrument, and the ends of the yarn which is in the case or box, are to be again coated with cement, and so on till the whole is cut up into slices, which may be afterwards applied, by cement, to canvas or other fabrics, or to other surfaces, or in place of cutting when the fibres have been only combined with cement, they may be further combined by cementing on canvass or other fabrics before cutting ; and for hats and such like fabrics, where it is desired to have a laid nap, then this may be accomplished by having the end of the boxes or cases from which the cut is made, on a bevel, and the face of the ram also of a bevel. Hence each slice or surface will be protruded and cut on a bevel or angular direction, and when cemented together will produce a laid nap surface or fabric.

Having now given to the reader a practical description of this novel method of manufacturing carpets, rugs, and other similar fabrics, we would, before dismissing the subject, further remark, that we see nothing to prevent the application of steam or water power, instead of manual labour, in performing all the operations required. By this means, 60 strips of metal, to raise the nap or pile, might easily be inserted per minute; at the distance of about 2 yards from the scene of action, where the inserting process was going on,

a cementing or soldering apparatus could be at work simultaneously; and at the distance of other two yards from this, another contrivance might be actively engaged in cutting out the strips as fast as they advanced with the cemented fabric; which would here be quite dry. The distance of this point from the last inserted strip would, of course, be about 4 yards; and, allowing 20 strips to the inch of the piled or napped fabric, only 2880 strips would be required for the 4 yards, from beginning to the end thereof. We think that from 300 to 305, or 306, yards of perfect nap or pile might be produced per day, from one machine of this description, working 10 hours, and with the superintendence of a *mere child.* Should any of the enterprizing individuals, who may chance to embark in such an undertaking, meet with any difficulties, they must not be discouraged; for every obstacle must vanish, or at least give way, when opposed by the combined powers of body and mind.

CHENILLE.

The ingenious Alexander Buchannan, of Paisley, Scotland, invented this beautiful fabric, about the year 1820.* It derives its beauty and lustre from the peculiar mode of preparing the weft, and the manner in which the colours are afterwards arranged; in so much, that a pattern which would require a large harness, as an imitation shawl, can be woven without any other apparatus than a ground mounting and two treadles.

The weft, which is called chenille, is prepared as follows:—A Turkey gauze warp, of net yarn, is woven in a 1200 reed, with a twist or dentful in every fifth interval, the weft being either silk, cotton, or worsted, according to the kind of shawls to be manufactured. When this fabric comes from the loom, it is cut up (by a suitable machine) in the centre between the dentfuls of warp; and after receiving a little twist to throw the ends of the cut weft into a spiral

* About this period, Mr. Buchanan exhibited a specimen of his newly invented fabric, to his worthy fellow-townsman, Robert Farquharson, Esq., then provost of Paisley; which circumstance is thus alluded to by a local poet:—

"Philanthropic Rab,
Sae smooth o' heart, though rough o' gab,
Soon as he saw the curious wab,
He gaz'd wi' wonner,
And said, it was a genuine job,
Upon his honour."

direction, it is ready for the weaver. The warp of the shawl is likewise a Turkey gauze, the same as that which is the foundation of the weft, so that when a sufficient quantity of chenille has been produced from a warp, it is customary to make shawls of the remainder. See Chenille Paper, page 511.

In weaving these shawls, one pick of the chenille is thrown in, and then three of the common weft, whether silk, cotton, or worsted, and the fibres of the chenille, projecting in all directions, give the fabric the appearance of a fine glossy shag, showing the pattern, when figured, alike on both sides.

When the shawls are to be of one uniform colour, only one kind of weft is necessary; but when they are to be figured, different colours are employed, and these are woven in spaces adapted to the different parts of the design; the pattern is painted on design paper, as for an imitation harness; each space of the design, or that which corresponds to a ground lash with its different colours, is again painted on a separate slip of design paper, but two spaces are here coloured, to make them better seen by the weaver, leaving a blank space on each side: these slips are all numbered, to prevent confusion.

Supposing a web of trimmings were to be woven, with eight repeats in the breadth of a yard, for the first pick of chenille, we take the slip of paper No. 1; by reading it, as for a sample, there are 2 spaces yellow, 1 white, 4 red, 2 yellow, 1 black, 2 white, &c., the weaver works a space of each of these colours on the warp, agreeably to its respective size on the slip of design paper, which, when finished, must be exactly the breadth of the trimming. For a guide to the weaver, the slip of paper passes through the reed, and is fastened at each end to a piece of tape, by a bit of rosin, the one behind the mounting hanging over the warp roller and kept tight by a small weight, and the other is fastened at the face of the cloth. The weaver then has only to change his shuttles, by shifting the boxes of the lay at the end of each coloured space, as pointed out by the design. The slip marked No. 2 is next put in the reed for the second pick, and the colours woven in the same manner, but in reverse order to the first, as the one is thrown in from the right hand and the other from the left, and so on till the weft for the whole pattern is finished.

The weft is cut in lengths of eight yards, being the quantity usually wound on one bobbin or quill, and this will make eight picks in a yard-wide web; and the bobbins are taken in succession, agreeably to the numbers of the slip of design paper. The more tightly

the chenille is twisted, the thicker and closer the pile becomes. This species of fabric is likewise well adapted to the rug and carpet manufacture.

It appears to us, that no person who is unacquainted with weaving can have any idea of the variety and ingenuity of its processes; and even some individuals who consider themselves masters of the art, know, comparatively, very little about it. Notwithstanding the apparent perfection of the methods employed in producing some of the fancy textures which we have already described, yet, we have to record improvements of immense importance upon several of them.

The manufacture which we have just been considering (chenille) has recently been adapted to carpets, rugs, &c., with great success, by Messrs. Templeton and Quiglay, of Paisley, who obtained a patent, in England, dated 25th July, 1839, for improvements, which we shall now proceed to explain.

The invention consists in weaving fabrics of silk, cotton, woollen, linen, or other fibrous materials, which are to be cut into strips, and used as weft, somewhat in the manner of chenille weft, (but with this difference, that the two edges of the strip shall incline more towards each other,) and then weaving such strips on a ground, so that all the fur or cut edges of the strips may be brought to one side of the fabric, while the other side is plain; and is also applicable to the manufacture of carpets, rugs, shawls, mats, covers of stools, chairs, or tables, tapestry, or any cloth or fabric requiring to be raised, so as to have the appearance of velvet, fur, or plush.

A texture or fabric of silk, cotton, woollen, linen, or of a mixture of two or more of these materials, is first woven; having the warp threads spaced or set in the reed at certain equal distances from each other, in the following manner:—One, two, or more dents of the reed are filled with the warp threads, and then a space of the reed, (*equal to double the length of the fur required,*) is left empty; then one, two, or more dents of the reed are again filled with warp threads, and another space is left empty, as above described (see Fig. 130;) and this is repeated until the required number of strips is completed. The warp being thus spaced and arranged in the loom, the weft is thrown in, so as to form either a plain or coloured surface, and the warp acts on the weft in the manner of gauze or cross-weaving (see Figs. 49, 50 and 53:) that is, the warp threads, instead of being left parallel, as in common weaving, are crossed over each other by each tread on the treadles; and the weft, when thrown in, intersects the warp, and its edges acquire a tendency to

come together, in consequence of the cross-weaving whi warp has received. On this web being cut into strips, throu vacant spaces already described, the weft, or lateral fibres c sides of each strip, are all thrown up on one side, and brougl together. The process is somewhat similar to that follo\ making chenille weft, but with this difference, that the fur (that is, the lateral fibres of both sides of each strip,) when c all brought upon one side, and into close contact, instead of] ing from all sides of the warp or body thread, as in the case (nille weft.

Fig. 130

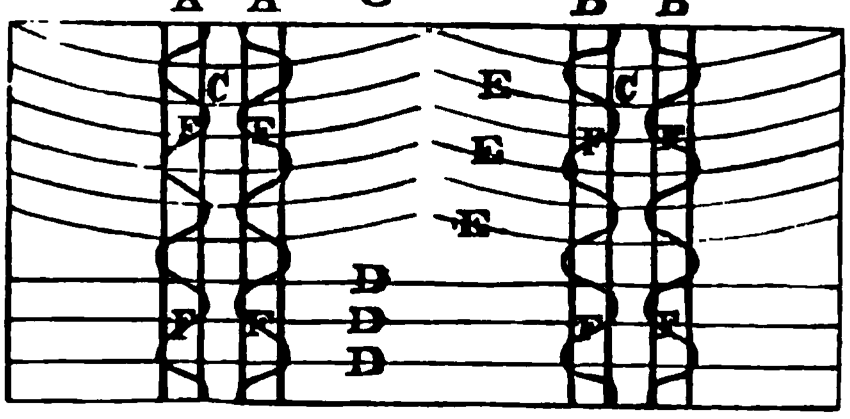
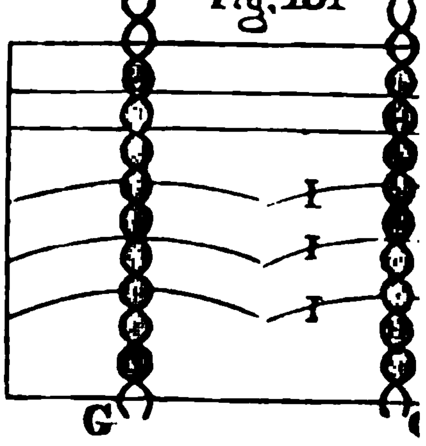


Fig. 131



At Figs. 130 and 131, are represented two modes of cross ing, exhibiting the crossings of the warp, and intersections weft. In Fig. 130, are two dents-full of warp A A of Turkey (B B is a repetition of the same,) of three threads in the dent : two dents-full being separated by one empty dent C C, or oth Three picks of weft or fur D D D are uncut, and six picks cut in the centre. The Fig. exhibits the effect which the cr F F of the warp threads have upon the fur, in causing bot of the weft, when cut, to incline towards each other, leavi warp threads to serve as a back-bone or back-band to the threads or fibres. Fig. 131 exhibits two crossing threads G C ing round a cord or dead thread H H, which is accomplishe "bead lams" (see gauze weaving, Fig. 49.) This Fig. al hibits, in some degree, (by the turned up ends of the cut weft t I I I,) the appearance of the fur when woven, and the effe crossings produce after it has been cut.

The pattern intended to be produced on cloth, manufa partly with the prepared weft, is copied on design paper, i *with as many horizontal lines as there are to be picks of ti pared weft in the cloth ; after these lines of the design pa] cut asunder into strips, and numbered, the weaver enter: through the reed of the loom,* (beginning with number one

commences to weave the colours of weft, in the exact order in which the colours are painted on these pieces of paper.

The ground-warp of the cloth is prepared with an extra warp, which may be termed the catcher-warp; a shed is formed by both warps, to receive the ground-weft, but a shed of the catcher-warp only for the prepared weft; there being fewer threads of the catcher-warp than the ground-warp, less resistance is offered to bringing the fur of the weft to the surface. In some cases, a portion of the ground warp is used for fixing the fur-weft upon the surface. The weaver having thrown in a pick of the fur-weft, sets it in its proper place with his hand, or otherwise, and then, with a brush, comb, or other instrument, raises all the fibres of the fur from the catcher-warp, or that part of the ground-warp which is to fix it on the fabric, and drives it firmly up with the reed. He now throws in as many ground or binder picks as are deemed necessary to form the ground of the cloth, and then repeats the operation of weaving in the fur, and so on, alternately, until the required length of cloth is produced.

TAPESTRY.

> "This bright art,
> Did zealous Europe learn of Pagan hands,
> While she assay'd with rage of holy war
> To desolate their fields: but old the skill:
> Long were the Phrygians' pict'ring looms renown'd;
> Tyre also, wealthy seat of art, excell'd,
> And elder Sidon, in th' historic web."—*Dyer.*

As we have, in the introductory part of this Work, (to which the reader is referred,) given ample evidence of the skill of the ancients in the manufacture of tapestry, in all its varieties, it only remains to give some account of its progress after its introduction into Europe.

The first manufactories for weaving tapestry which acquired reputation in Europe, were those of Flanders, and they appear to have been long established in that country, principally at Arras, before they were introduced either into England or France: the precise period when tapestry was first manufactured by the Belgians is uncertain. Guicceardini, in his history of the Netherlands, published at Antwerp in 1582, ascribes to them the *invention* of tapestries, without mentioning any particular date. Whether the Belgians did or did not derive their knowledge from the East, to them is certainly due the honour of having restored this curious art, which

gives a life to wools and silks, scarcely, if at all, inferior to the paintings of the best masters. The weaving of tapestry was first introduced into England in the time of Henry VIII, by William Sheldon, but it was not until the reign of James I, that it acquired any particular reputation. This monarch greatly patronized the art, and gave the sum of two thousand six hundred and seventy-six pounds sterling towards the advancement of a manufactory, which was established by Sir Francis Crane, at Mortlake in Surrey. The patterns first used for making these fabrics in England, were obtained from pieces which had already been worked by foreign artists.* There is an extract in Rymer's "Fœdra," an acknowledgement from Charles I, that he owed Sir Francis Crane the sum of six thousand pounds Sterling for tapestries, and that he grants him the annual sum of two thousand pounds, for ten years, to enable him to support his establishment.

To France, however, we are indebted for the great perfection to which this costly art has been brought in Europe. Henry IV, first established a tapestry manufactory in Paris, about the year 1606, which was conducted by several clever artists, whom he had invited from Flanders: but this, like many similar institutions founded by that monarch, was greatly neglected at his death, and would probably have been entirely so, had not Colbert the minister of Louis XIV, with a view of providing the costly and magnificent furniture for Versailles and the Tuilleries, again remodeled it upon a more secure foundation, and from that period the royal manufactory of the "Hotel des Gobelins" dates its origin.

As early as the fourteenth century, dyers of wool were settled in the Faubourg St. Marcel (Quartier St. Marcel) at Paris, on the banks of the Bievre, the waters of which stream were considered as favourable to the process of dyeing. One of these named Jean Gobelin amassed considerable wealth, which his descendants increased, and at length renouncing the business of dyers, filled various offices of state.

The Gobelin family were succeeded by Messrs. Canaye, who however did not confine their attention to the dyeing of wool, but under the patronage of Henry IV, commenced the working of tapestry, which until that period had been confined to the low countries. To these succeeded, in 1655, a Dutchman, named Glucq, and one Jean Lianson, a workman, and a great proficient in the

* The designs were furnished by Thomas Cleyn, (a Fleming,) who was retained by Sir Francis for that purpose.

art. Louis XIV, at the suggestion of his minister, Colbert, afterwards purchased the buildings and gardens, which were still the property of the Gobelin family, from which circumstance the tapestry made there, has ever since been known as "Gobelins tapestry." Skilful artists, weavers and dyers, were brought from Flanders, and attached to the establishment; and in 1667 the celebrated painter, Le Brun, was appointed chief director of the Gobelin manufactory, to which he communicated that beauty and grandeur, his admirable talents were so well calculated to produce. He here painted the famous series of the battles of Alexander, which were afterwards worked in tapestry, and still remain the finest productions of the Gobelins. The four seasons, the four elements, and the history of the principal acts of Louis XIV, from his marriage to the conquest of Franche Comte were also from the design of this master.

At the period of the French Revolution this manufacture, which had until then been prosecuted with various degrees of success, greatly declined, but under the government of Napoleon, it was again revived, and has since been successfully carried on, although not to the same extent as formerly. About the year 1801, seventy-six persons were employed at the Gobelins, chiefly in the preparation of tapestry, for the palace of St. Cloud; and it was estimated that 150,000 francs were expended yearly on these productions. The pieces executed are generally historical subjects, and it occasionally requires the labour of from two to six years to finish a single piece of tapestry. The cost of some of these pieces is enormous, but the price of the different articles is regulated less by the size than by the beauty and difficulty of the work.*

The productions of this manufactory, which is entirely supported by the government, are chiefly destined for royal palaces, or for presents made by the king; but some few pieces, not designed as such, are allowed to be sold.

Connected with the establishment of the Gobelins, is one for the dyeing of wool, under the direction of able chemists, where an infinite number of shades, mostly unknown in trade, are dyed for the tapestry. Wool is now exclusively used, as the colours are more permanent. There is also a drawing school, in which the principles of the art are taught, and an annual course of lectures is delivered upon chemistry as applicable to dyeing.

The Gobelins tapestry was formerly made in lengths or pieces, the width of which varied from four to eight feet; and when one

* Some pieces are valued at from 50,000 to 125,000 francs.

of larger dimensions was required, several of these were sewn or fine-drawn together with such care that no seams were discernable. At the present day, however, they are manufactured of much greater widths, so that they seldom require to be joined even in the largest pieces.

Two methods were formerly practised in the manufacture of tapestry, known as those of the "*basse lisse*" and the "*haute lisse*;" in the first or low warp, which is now abandoned, the warp threads were arranged horizontally in a frame, as in looms for common weaving, the painting intended to be copied being placed beneath the warp, and the process was very remarkable, from the fact of the tapestry being worked on the wrong side, so that the artist could not see the face of the design he was weaving, until the whole piece was finished and taken out of the frame. In the top headles or high warp, which is still used, the frame is fixed perpendicularly before the artist, he also works, as it were, blindfolded, seeing nothing of the effect he produces, and being obliged to go to the other side of the loom whenever he wishes to examine the piece he is executing. The following brief description of the mode at present practised at the Gobelins, may perhaps convey some idea of the manufacture to those who have not visited this most interesting establishment.

The frame or loom in which the tapestry is worked is of the most simple construction, consisting merely of two upright posts with suitable cross-bars at top and bottom; between these posts two rollers or beams are placed, with ratchet heads and clicks or dogs to hold them, similar to the ratchet R and dog S in Fig. 105. To these rollers or beams, are connected the longitudinal threads or warp, composed of twisted wool, wound principally upon the upper roller which may, therefore, be denominated the warp beam, the other, of course, being the cloth beam.* The longitudinal threads are separated from one another by suitable contrivances, made and provided for that purpose, which the reader will easily under-

* It is a very remarkable coincidence, that the tapestry frame should in all respects bear so close a resemblance to Ghelen's machine or loom, represented at Fig. A, page 22 (see Introduction); and it goes far to strengthen the opinion we had previously formed of the superiority of talent possessed by the ancients over the moderns; by this assertion, however, we are not to be understood as insinuating that either the French or Belgians copied Mr. Ghelen's frame, as we are credibly informed that they had never heard of it, but only struck upon the same idea, by chance, after much reflection upon the subject.

stand. The division of the threads is effected in order to admit the cross threads, or tufts of yarn, which are to form the picture.

As a sort of guide for the artist, to introduce the cross threads in their proper places, he traces an outline of his subject on the threads of his warp in front, which are sufficiently open to enable him to see the painting behind it.

For working the tapestry, three instruments are required, a broach, a comb, and an iron needle; the first is formed of hard wood, about 7⅝ inches in length, and ⅝ of an inch thick, ending in a point, with a small handle, round which the wool is wound, and serving the same purpose as the weaver's shuttle. The comb is also of wood, eight or nine inches long, and an inch thick at the back, whence it gradually decreases to the extremity of the teeth, which are more or less divided, according to the greater or less degree of fineness of the intended work: it is used to press close the wool, when any line or colour does not set well. The artist places himself behind the frame, with his back towards the picture he is about to copy; he first turns and looks at his design, then taking a broach of the proper colour, he inserts it among the threads of the warp, which he brings across each other with his fingers, in precisely the same way that weavers read their patterns on the simple or simples of the draw loom (see Fig. 70 and its explanation;) this he repeats every time it is necessary to change his colour. Having placed the wool, he beats or presses it down with his comb; and when he has thus wrought several rows he passes to the other side, to see their effect, and to properly adjust them with his needle, should there be occasion.*

An entire new species of tissue and tapestry has been invented or discovered by M. E. Pavy, and secured by patent, which promises to become an article of great commercial value. In particular, we would refer to some coverings of chairs and tapestry which have been especially ordered by her Majesty Queen Victoria, for the palace. It bears so close a resemblance to silk of the best kind, that it is difficult without a minute examination to discover the difference. The material of which it is composed is the fibre of the banana, aloe, and other trees and plants which are plentifully

* Should the workman have a lively sense of the charms of nature, with what feelings of exquisite delight must he gaze upon the form of a beautiful female, springing up in the most glowing colours amid the threads, spread like a cobweb, before his enraptured eyes, and all that too through his own instrumentality! Tapestry weavers generally die of a broken heart!

found in the West India islands; and by very accurate experiments made by order of the French Government, they have been found on an average to exceed the strength of hemp by one-fourth. The experiments were made at Toulon, upon cordage which had been six months exposed. We understand that the French Minister of Marine has introduced ropes and cables made of this material into the Royal Navy; and as it is so much superior to hemp, we see no reason why it might not be advantageously employed in the cordage of the military and commercial navy of this country. It might also be used with profit in the manufacture of pile carpets and hearth-rugs, as well as in many other important branches of the arts.

CASHMERE SHAWLS.

> "These are the gifts of Art, and Art thrives most
> Where commerce has enriched the busy coast;
> He catches all improvements in his flight,
> Spreads foreign wonders in his country's sight,
> Imports what others have invented well,
> And stirs his own to match them or excel.
> 'Tis thus reciprocating, each with each,
> Alternately the nations learn and teach."
>
> *Cowper.*

Cashmere is a very rich and fertile province, surrounded with mountains, in the northern part of Hindostan; its chief city is of the same name, and contains about 205,000 inhabitants: this country is famous for its shawls.

Before, however, proceeding to describe the method of manufacturing those beautiful fabrics, we will in the first place, give a minute account of the origin and properties of the Cashmere Angora Goats, or rather of the new race, with a statement of Mr. E. Riley's views in purchasing them, as laid by him before the Society of arts, London.

"Many years since a resident in New South Wales (says Mr. R.) and having in 1825 and 1828 transported to that territory two flocks of the finest sheep procurable throughout Germany, my father had also long contemplated introducing there the celebrated Cashmere goat, anticipating that the fulfilment of his views would, in proving advantageous to himself, become also of ultimate benefit to the colony; in which expectation, he has been encouraged from the results that have attended the importation of the Saxon breed of sheep into their favoured climates, the wools of New South Wales,

and in proportion to their improvement, those also of Van Dieman's Land being now eagerly purchased by the most intelligent manufacturers in preference to those of equal prices imported from any part of Europe.

"With this object in view, he subsequently, during an agricultural tour on the Continent, directed my attention to the Cashmere flocks of Mons. Ternaux, and in October 1828, I met this distinguished man at his seat at St. Onen (Mons. Ternaux is a great shawl manufacturer and is also a Peer of France,) where he preserved the elite of his herds; the animals were a mixture of various sizes and colours, from a perfect white to brown, with scarcely any stamped features as if belonging to one race exclusively; they were covered with long coarse hair, under which so small a quantity of short soft down was concealed, that the average produce of the whole collection did not exceed three ounces each; therefore, under these unfavourable circumstances, my father deferred for a time his intention of sending any of them to Australia.

"I was then advised, by the Viscomte Perrault de Jotemps, to see the stock of M. Polonceau at Versailles, he having, by a happily selected cross, succeeded in increasing the quantity and value of the qualities of the Cashmere goat beyond the most sanguine anticipations; this gentleman is "*ingenieur en chef*" (chief engineer) to the French government, and in consequence of his enlightened taste for agricultural pursuits, was also honoured with the directorship of the "*ferme modele*" (model farm) at Grignon. He became among the first to purchase a chosen selection of the original importation of the cashmere goat from M. Ternaux, and sometime after seeing, at one of the estates of the Duchesse de Beri, an Angora buck with an extraordinary silkiness of hair, having more the character of long coarse but very soft down, ***he solicited permission to try the effects of a union with this fine animal and his own pure Cashmeres.*** The improvement even in the first drop was so rapid that it induced him to persevere, and when I first saw his small herd they were in the third generation from the males produced solely by the first cross; the unwillingness however of M. Polonceau to part with any number of them at this period (the only alienation he has made from the favourite products of his solicitude being two males and two females to the King of Wirtemberg, for the sum of 3400 francs,) caused my father again to postpone his intentions until my return from the Australasian Colonies, judging that M. Polonceau would then probably be enabled to dispose of a sufficient number, and that the con-

stancy and properties of the race would by that time be more decidedly determined.

"On my arrival in England at the close of 1831, he again recurred to his favourite project of introducing these animals into our colonies, for which purpose I went to France with the intention of purchasing a small flock of M. Polonceau, should I find all his expectations of the Cashmere Angora breed verified, which having perfectly ascertained, I at length succeeded in persuading M. Polonceau to cede to me ten females in kid, and three males, and I fortunately was able to convey the whole in health to London, with the intention of proceeding as speedily as possible with them to Port Jackson, looking sanguinely forward not only to their rapid increase but also to *crossing the common goats* of the country with this valuable breed, in full expectation that they may, exclusive of their own pure down, become thus the means of forming a desirable addition to the already much prized importations from New South Wales and Van Dieman's Land. I am led to the conclusion that the latter result may be accomplished, as M. Polonceau, who has tried the experiment with the native goat of France, has obtained animals of the second cross very little inferior to the breed that has rendered his name so distinguished. He has also crossed the common goat with the pure Cashmere, but only obtained so tardy an amelioration, that it required eight or ten generations to produce a down simply equal to their inferior quantity and quality when compared to the produce of the Cashmere Angora."

From the opinion generally entertained of their value, and by several eminent manufacturers, of the peculiar qualities of their improved down, with the interest they express in their intended introduction into the British Colonies, W. Riley revisited France, and again induced M. Polonceau to admit of a similar selection from his herd with also two bucks and two does of the pure Angora race from the Duchesse de Beri.

ORIGIN AND PROGRESS OF THE NEW RACE OF CASHMERE OR ANGORA GOATS.

M. Polonceau created the new race of Cashmere Angora goats, in 1822, by crossing the pure Cashmeres imported into France by M. Ternaux and M. Jaubert, (Monsieur Jaubert has been a member of the Chamber des Deputies for several years past,) under the protection and patronage of the French government, in 1829, with the pure breed afterwards introduced into France from Angora.

Since that period he has unremittingly persevered in the improvement so immediately effected, and has proved during the several years which have elapsed, that an entire satisfactory result in the union of the most essential qualities of down, *abundance, length, fineness, lustre, and softness*, was accomplished by the first cross, without any return having ensued to the individual characters of either of the primitive races, and in consequence, he has since constantly propagated the produce of that cross among themselves, careful only of preserving animals entirely white and of employing for propagation those bucks which had the down in the greatest quantity and of the finest quality with the smallest proportion of hair.

In 1826, the "Societie Royale et Centrale d' Agriculture de Paris" acquainted with the interesting result of M. Polonceau's flock, being at that time in the third generation, and considering that the down of this new race was more valuable than that of the East, and that it was the most beautiful of filaceous materials known, as it combines the softness of Cashmere with the lustre of silk, awarded him their large gold medal at their session, 4th April 1826, and nominated him a member of their society in the following year.

In 1827, at the exhibition of the produce of National Industry, the jury appointed to judge the merits of the objects exposed, also awarded him their medal.

At present the animals are in the twelfth generation, their health and vigour, the constancy of their qualities, and abundance of their down without any degeneration, prove that this new race may be regarded as one entirely fixed and established, requiring solely the care that is generally observed with valuable breeds; that is to say, a judicious choice of those employed for their reproduction, and in such a climate as New South Wales it may be reasonably expected that the brilliant qualities of their down may yet be improved as has been so eminently the case with the wool of the merino and Saxon sheep imported there.

M. Polonceau has goats that have yielded as many as thirty ounces of the down, in one season, and he states that the whole of his herd produce from twelve to twenty ounces; thus showing the astonishing advantages this new breed has over the uncrossed Cashmere, which never yield more than four ounces and seldom exceed two ounces each.

This gentleman also states, that, the Cashmere Angora goats, are more robust and more easily nourished than the common goat, and that they are less capricious and more easily managed in a

flock; and from the experience he has already had, he finds them much more docile than even sheep. They prefer the leaves of trees, as do all other goats, but they thrive either on hay or straw, or green fodder, or in meadows; they also feed with equal facility on heaths, and on the most abrupt declivities, where the sheep would perish; they do not fear the cold, and are allowed to remain all the winter in open sheds. For the first year or two of M. P's. experiments he thought it prudent to give them aromatic herbs, from time to time, but during the last six years he has not found it necessary. He knows not of any particular disease to which they are subject, his flock never having had any. M. P. arranges they should kid in March, but occasionally he takes *two falls* from those of sufficient strength during the year.

The down commences to grow in September, and developes itself progressively until the end of March, when it ceases to grow and detaches itself, unless artificially removed.

To collect the down, he waits the period when it begins to detach itself, and then the locks of down which separate from the skin with little force are taken off by hand; the down is taken from the animals every three or four days; in general it first begins to fall from the neck and shoulders, and in the following four or five days from the rest of the body; the collection is completed in the space of eight or ten days. Sometimes the entire down can be taken from the animal at one shearing, and almost in an unbroken fleece, when it begins to loosen. The shearing has the advantage of preserving more perfectly the parallelisms of the individual filaments, which much increase the facility of combing and preparing the down for manufacture.

The mills for spinning Cashmere wool have multiplied very much of late years in France, and the prices of the yarn have fallen from 25 to 30 per cent. notwithstanding their improved fineness and quality. There is a fabric made with a mixture of Cashmere down and spun silk, which is becoming very general: one of the manufacturers, M. Hindenlang, exhibited samples of Cashmere cloth woven with yarn as fine as No. 130 for warp, and No. 228 for weft.

Messrs. Polino, Brothers, of Paris, produced an assortment of Cashmere pieces from 22 to 100 francs per yard, dyed of every fancy shade: their establishment, at Ferti Bernard, employs 700 operatives with an hydraulic wheel of 60 horse power.

The Oriental Cashmere shawls are woven by processes extremely slow, and consequently costly, whence their prices are very high;

still sold in Paris at from 3500 to 2500 francs each, and even 50,000 francs have been paid for one shawl. It became necessary, therefore, either to rest satisfied with work which should have merely a surface appearance, or contrive economical methods of weaving, to produce the real Cashmere style with much less labour. By the aid of the draw loom, and still better, the Jacquard loom, M. Ternaux first succeeded in weaving Cashmere shawls perfectly similar to the Oriental in external aspect, which became fashionable under the name of French Cashmere. But to produce shawls altogether identical on both sides, with the Eastern, was a more difficult task, which was accomplished only at a later period by M. Bauson of Paris.

In both modes of manufacture, the piece is mounted by reading in the warp for the different leaves of the headles, as is commonly practised for warps in the Jacquard loom. The weaving of imitation shawls is executed as usual by as many shuttles as there are colours in the design or pattern, and which are thrown across the warp, in the order established by the *reader*. The greater number of these weft yarns being introduced only at intervals into the web when the composition of the pattern requires it, they remain floating loose at the back of the piece and are cut afterwards without affecting in the least the quality of the texture, but there is a considerable waste of stuff in the weaving, which is worked up into carpets.

The weaving of the imitation of real Cashmere shawls is different from the above. The yarns intended to be for the weft are not only equal in number to the colours of the pattern to be imitated, but besides this, as many little shuttles, (like those used by embroiderers and lace manufacturers. See Figs. 135 and 136,) are filled with these yarns as there are to be colours repeated in the breadth of the piece, which renders their number considerable when the pattern is somewhat complicated and loaded with colours; each of these small bobbins or shuttles passes through only that portion of the flower or pattern in which the colour of its yarn is to appear, and stops at the one side and the other of the cloth, alternately, exactly at its limit; it then returns upon itself after having crossed the thread of the adjoining shuttle: from this reciprocal intertexture of all the yarns of the shuttles, it results, that although the weft is composed of a great many different threads they no less constitute a continuous line in the whole breadth of the web upon which the lay or batten acts in the ordinary way.

We see, therefore, that the whole art of manufacturing this

Cashmere cloth consists, in avoiding the confusion of the shuttles, and in not striking up the lay till all have fulfilled their function. The labour does not exceed the strength of a woman, even though she has to direct the loom and work the treadles: seated on her bench at the end opposite to the middle of the beam, she has for aids, in weaving shawls from 45 to 52 inches wide, two girl apprentices, whom she directs and instructs in their tasks. About four hundred day's work are required for a Cashmere shawl of that breadth.

In the Oriental process all the figures in relief are made simply with a slender pirn, without the shuttle used in European weaving. By the Indians, the flower and its ground are made with the pirn by means of an intertwisting which renders them, in some measure, independent of the warp.

Considered in reference to their materials, the French shawls present three distinct classes, which characterize the three fabrics of Paris, Lyons, and Nimes. Paris manufactures the French Cashmere, so called, of which both the warp and the weft are the yarn of pure Cashmere down; this web represents with fidelity, the figures and the shades of colour of the Cashmere shawl which it copies: the deception would be complete if the reverse of the piece did not show the cut ends, as in common shawl weaving. The warp of the imitation Hindoo shawl, also, woven at Paris, is composed of spun silk, which reduces its price without much impairing its beauty.

Lyons, however, has made the greatest progress in the manufacture of shawls; it excels particularly in the texture of its Thibet shawls, the weft of which is a mixture of wool and spun silk.

Nimes is remarkable for the low price of its shawls, in which spun silk, Thibet down, and cotton are all worked up together.

It appears that M. L. Girad, at Livres, near Paris, has succeeded best in imitating Cashmere shawls, exhibiting all the variety of design and colouring, which appears in the Oriental.

The shawl merchants of India admire the ingenuity of the French artists in imitating Cashmere shawls, but condemn the cloth on account of its harshness, which may consist in a difference in the twisting of the yarn. In the shawl country, there are three coloured wools, white, light brown, and dark brown, the two last are from Thibet, the other from Bholkera; the light brown will receive four colours, viz., black, blue, green and brown; the dark brown will receive only black, brown and blue. The shawl merchants state, that the colours in the English shawls are fugitive-

The colours now used do not exceed fifty in the most elaborate productions of the Cashmere loom. Formerly it was said that three hundred shades of colour were used.

The embroidery is not worked with the needle but woven in the cloth. The patterns are read off from a book, and not from a drawing. There is an embroidery language, by which the colours, number, division, and distribution and manipulations of the threads, and the forms and sizes of the flowers, foliage, &c., are symbolically designated. The looseness of twist in the web is owing to being done by the hand; these objections, however, have all lately been remedied by the ingenuity of the French artists, and particularly Messrs. Polino Brothers, of Paris.

SECTION EIGHTH.

LACE MANUFACTURE.

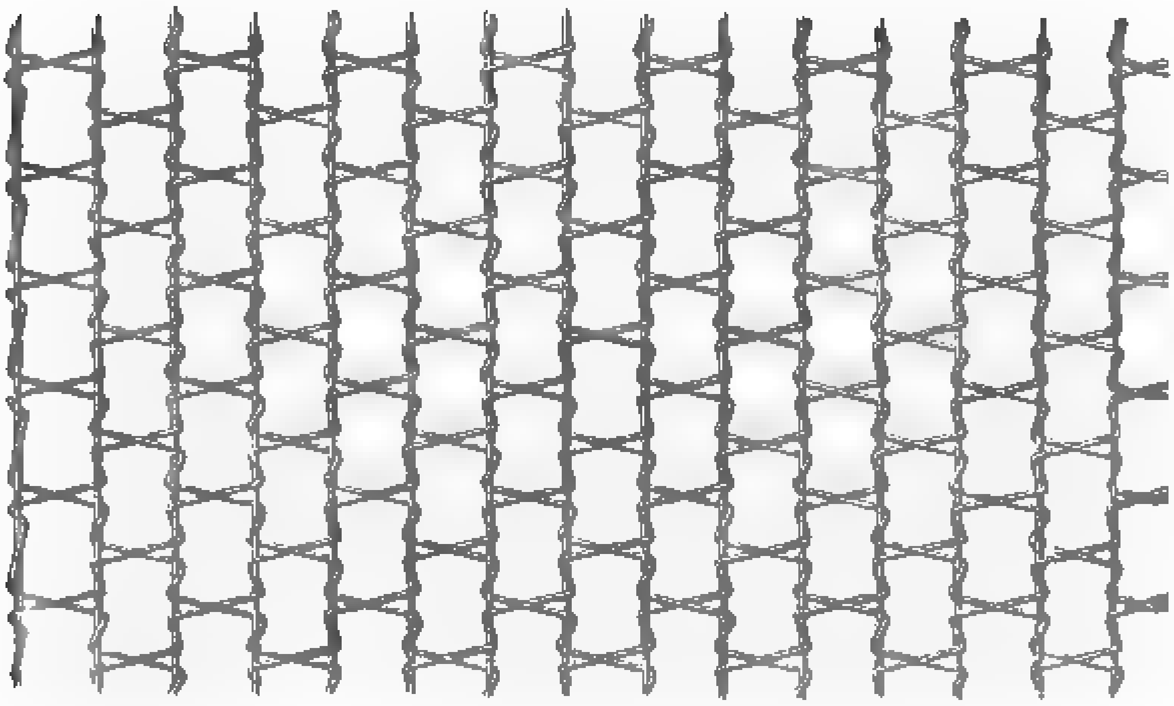
The history of the arts furnishes no instance of such remarkable changes in the wages of labour, and no such instructive lessons of the influence of mechanical improvements, as that afforded by the manufacture of bobbin-net lace. For some time after its commencement, in Nottingham, in the year 1809, it was common for an artizan to abandon his usual occupation and betake himself to a lace frame, in which he became a share holder, and realize by working upon it, from 20s. to 40s. per day. In consequence of such enormous earnings, Nottingham, with Loughborough, and the neighbouring villages, very soon became the theatre of an epidemic mania, unequalled in modern times.* Many unfortunate individuals, although destitute of mechanical genius or even talent of any kind, tormented themselves both day and night with schemes of bobbins, pushers, lockers, point-bars, and needles of every variety of shape imaginable, till their minds got permanently bewildered. Indeed, several lost entirely what little sense they once possessed; and

* For an account of the lace and net-work manufactures in ancient days, the reader is referred to the introduction.

others after cherishing visions of the most unbounded wealth, as i the dreamy age of alchemy, finding their projects abortive, sun into the lowest depths of despair, and committed suicide, *by blowin out their brains.*

Bobbin-net lace is a light semi-transparent texture of fine cotto thread, arranged in hexagonal meshes. This species of cloth o web is produced by means of a warp, the same as in plain weaving except that the threads are further apart. A specimen of this tex-ture is represented at Fig. 132.

Fig.132



The weft or filling, however is applied in quite a different way fro that of plain cloth: it consists, in the first place, of an equal number o threads with the warp; and these weft threads are made to revolv round every two threads of the warp, which changes the relativ positions of the warp threads. Second.—Among all the pairs o the warp-threads which have been thus twined together by weft thread, one of them is shifted to the neighbouring warp-thread upo the left, and connected to it by the convolution of the weft thread after which, the shifted warp-threads change back to their first po sition, where they are again entwined or laced together by the we thread, as before; and the other threads of these pairs shift to th right and are entwined or laced together in the same manner a the first or left hand set were. Third.—While this maneuvering i the positions of the warp threads is in progress, the weft thread which entwine or lace them together, also move to one side, an after the warp-threads have been laced or entwined twelve time

with a weft-thread, the latter moves sideways through one interval of the warp-thread, and, if it were coloured, would produce, in the course of fabricating the cloth, a diagonal line across it. The manufacture of lace, therefore, differs from plain weaving, in this, that the threads of the warp are not alternately raised and depressed, for the purpose of introducing the weft, but are shifted laterally to the next pair, to which they become united by the weft-threads, working likewise in pairs, each of them entwining two individual threads at once, as in the manner above explained.

Fig.133

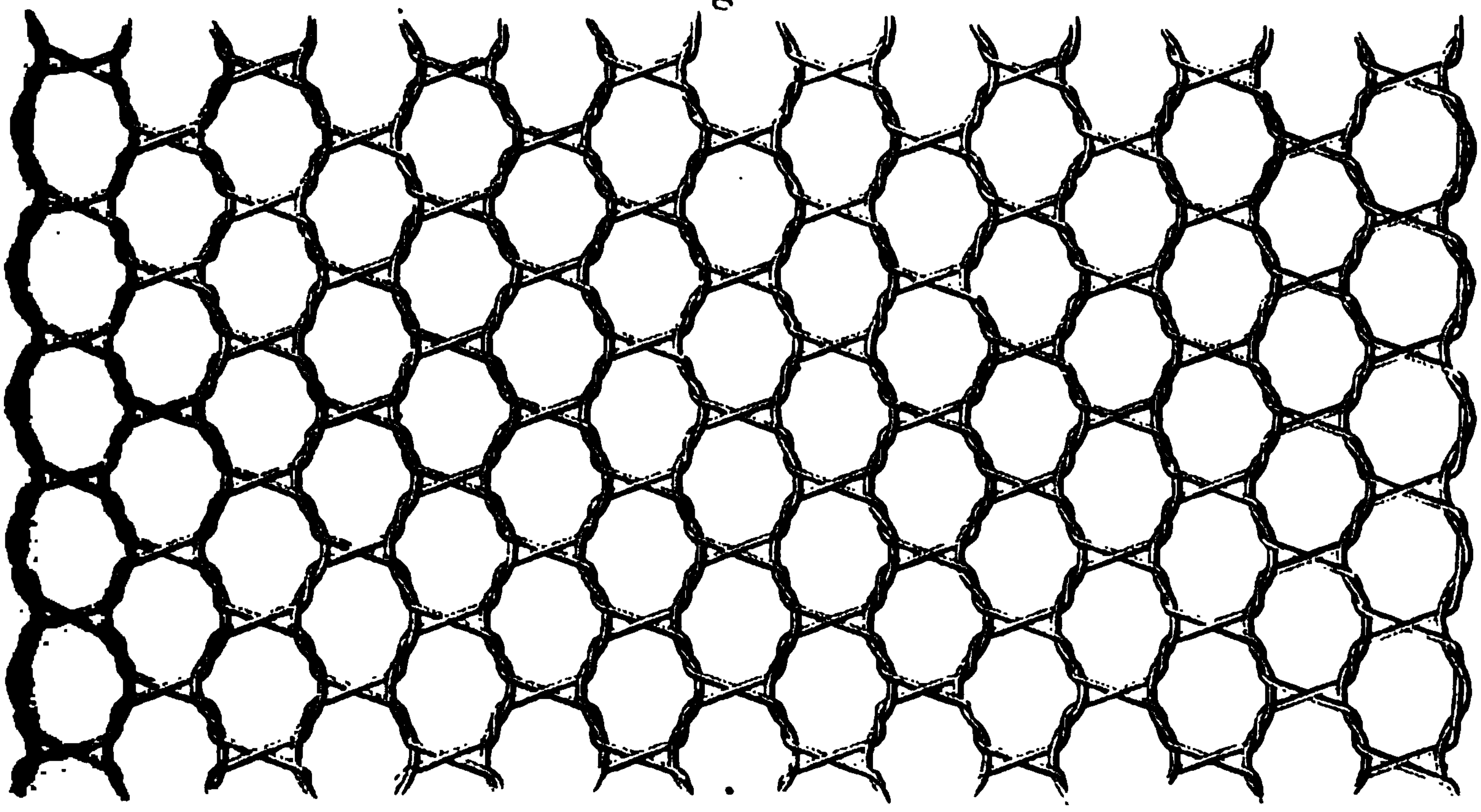


Fig. 133 will give the reader a more correct idea of the nature or mode of manufacturing this species of texture, by the crossing or twining of the warp and weft-threads together. This specimen shows, upon a magnified or enlarged scale, how the fabric is produced from the conjunction of three threads; one of which proceeds from the top, downwards, in a winding or wave line (constituting Hogarth's line of beauty;) the second of these threads runs towards the right, and the third to the left, crossing each other obliquely in the centre between each two meshes throughout the series, as shown in the Fig. The warp-threads, as before stated, are placed perpendicularly in the machine, and derive their curvature from the tension of the obliquely disposed weft-threads, by which they are alternately drawn to the right and to the left.

The weft-threads which are to pass through the intervals of the warp, in order to interlace or entwine two threads of the latter together, are wound upon little bobbins; one of which is represented, one fourth its real size, at Fig. 136. where both an edge and a side

view are given. It consists of two thin discs, cut out from shee brass, by a press or stamping machine ; and they are so connecte or riveted together, that a narrow space or circular groove is left be tween them, as shown in the edge view, Fig. 136. A roun hole is pierced in the centre of each bobbin, as shown in the Fig having a little notch or jog at one point, for guiding the bobbin upo a spindle with a feather upon it to fit the notch or jog ; which pre vents the bobbins from being misplaced on the spindle. Any con venient number of these bobbins are put upon a spindle, whic spindle is then arranged in a suitable winding machine, for th purpose of filling the bobbins with weft-thread, previous to bein put into their respective working positions in the lace-frame. Afte these bobbins have been filled with weft-thread, each of them i placed within a small iron frame, like that represented at Fig. 135 and this frame is known to lace manufacturers by the name of th bobbin-carriage : Fig. 135 exhibits a side view and section of thi frame, fourth its real size. Into the circular or gouged-out space o the carriage, the bobbin is inserted, so that the grooved border of its discs embraces the narrow edge A A ; and the bobbin is kept from falling out by the pressure spring B, which spring, also, com- municates sufficient friction to prevent it from revolving too easily; but yet allows the thread to be given off, when pulled with gentle force. The thread, as it comes from the bobbin, escapes throug the eye C, at the upper side or the top of the carriage ; after which it takes its relative position in the formation of the lace.

The variety of mechanical combinations to which this manufac ture has given birth, is without a parallel in any other branch o the arts. Since 1809, when Mr. Heathcoate obtained his first su cessful patent, a great number of other patents have been grante for making lace. But we shall confine ourself to giving a faithf description of the most recent improvements which have been ma in the manufacture of this kind of texture, namely, by the inge ious John Heathcoate, of Tiverton, county of Devon, a gentlema who may with justice be called, the father of the lace manufactu in Europe; and William Crofts, an ingenious mechanic of Ra ford, county of Nottingham, with whose improvements we sh commence.

Mr. Crofts' first invention consists in a mode of producing orn mental spots on a plain bobbin-net; which spots are formed wh the lace is in progress of fabrication, by means of coiling up an accumulating certain of the warp threads into masses, so as to pr

duce spots at such parts of the plain net as are required to form the intended pattern.

The invention, is an application of peculiarly jointed wires, in conjunction with hooks for catching the threads which are to be looped up, in order to form spots, with certainty and facility; the action of the hooks, being aided by the pointed wires, enables the machinery to perform without interruption, the backward and forward swinging motions, which are usually given to the bobbins and carriages, in circular comb rotary machines.

Fig. 134

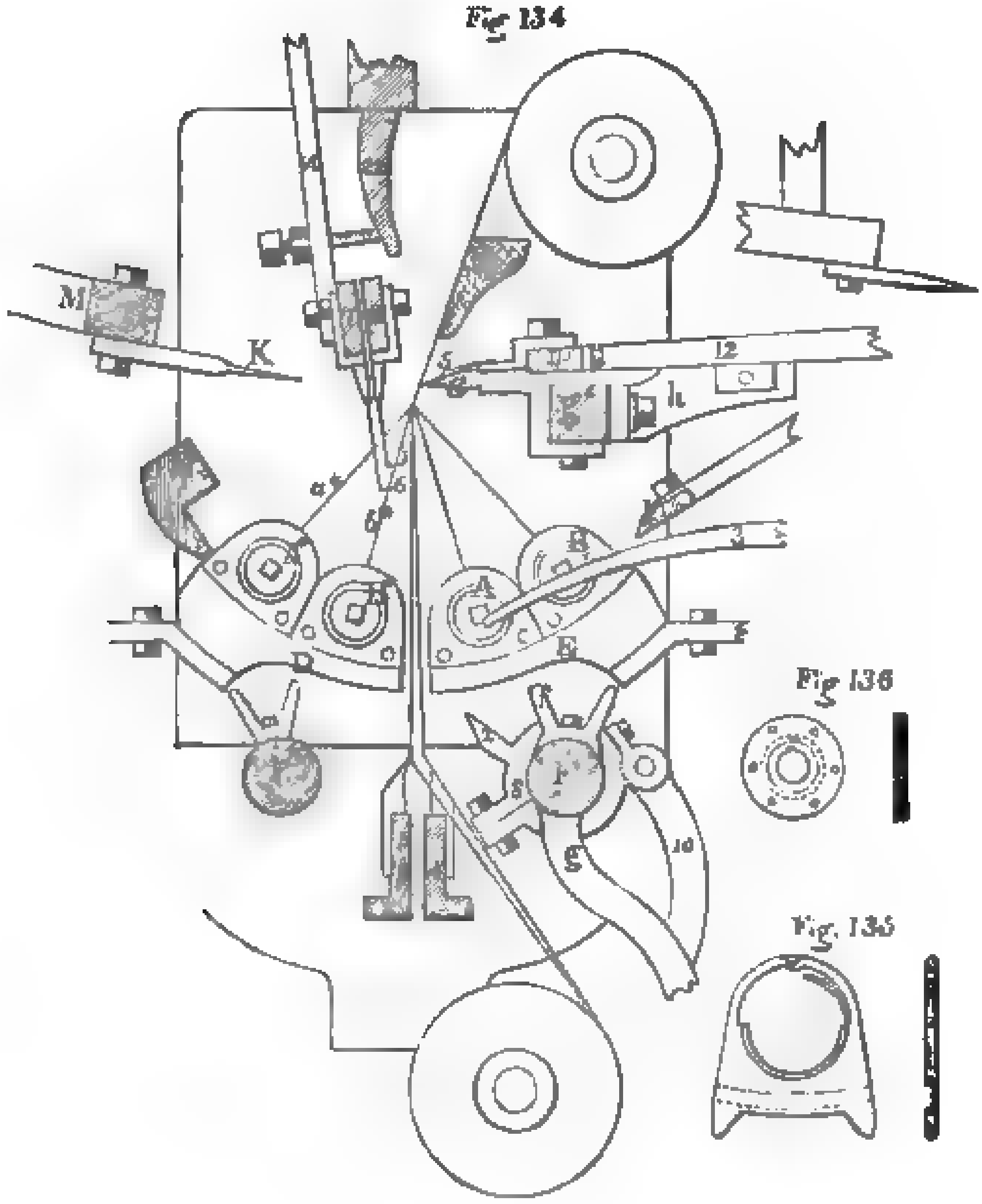


Fig. 136

Fig. 135

Fig. 134 represents the operating parts of a lace machine, taken in transverse section. When the spots are about to be formed, the front working points K, are drawn towards the front of the machine out of their working positions, and remain in a state of inactivity, during the formation of the spots. The bobbins A* and B,* with their threads a,* and b,* intended to form the spots, are then selected by the pushers 3, and projected forward out of their places in the

back combs E, into the front combs D. The bobbins A and B, not used for forming the spots, are locked in the back combs E, during the spotting operation, by the blade *f*, on the back locker bar F. There is likewise another blade 2, attatched to the collars 8, on the locker bar F, by means of which the bobbins A* and B* can be locked in the back combs E when required. The locker bar F receives motion from a lever *g*; and the collars 8, receive motion from a lever 10: both levers are worked by cams, not shown in the drawing. There is another locker bar F*, for working the carriages in the front combs D. The pointed wire bar 7 and the hook bar 13, are attached to the lever 14, by the same pin, but may receive slight shogging motions, the one independent of the other; they are raised and depressed by the lever 14, which receives its motion from various other levers and cams, but unnecessary to show in the drawings, as every person at all acquainted with the lace manufacture, will readily be able to understand them. The pointed wires 6, and hooks 1, are represented as descending amongst the bobbin threads, which are pressed on one side by the pointed wires 6, in order that they may be caught by the hooks 1; and these on ascending, loop the threads around the grooved back points G, and the additional back points 5; at the same time, the bobbin threads, by a suitable movement, are whipped twice round their respective warp threads.

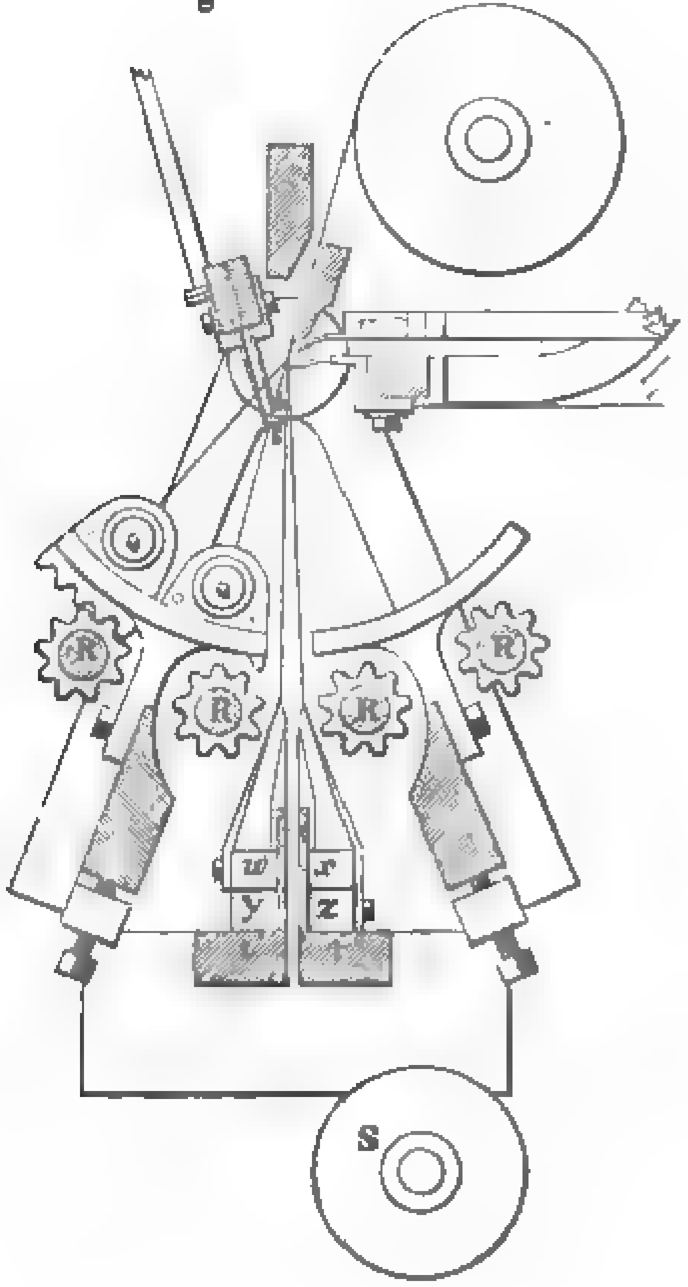
The back points G, lie below the additional back points 5, which enter into the grooves in the points G and assist in making the spots, as well as of keeping them in correct form. Their mode of application is shown in the figure; the points G being withdrawn as soon as the spotting is effected; leaving the points 5 in the centre of the spots in order to retain them in their places, until the points G are again inserted between the threads, beneath the spots.

The bar g^1 of the grooved back points G, is attached to the lever *h*, by which it is worked, and the bar 11, of the additional points 5, is attached to, and worked by the lever 12. The front points K are connected to, and worked by the lever M. H is the front driving bar, and I is the back one. The bars of the front and back guides for the warp threads are marked *t*, *t*. The wire and hook bars, 13 and 7, are guided up and down in front of the warp threads by the point of a gauge screw 21, bearing against the inclined face of a fixed conducting guide 22, fastened to the top of the framing.

The particular features of novelty in this part of Mr. Crofts's machinery are, the points and hooks above described, for selecting and drawing up the threads; the application of the additional back

points, for the purpose of keeping the spots and meshes o the net in correct form; and also in arranging the various parts of the additional machinery, which is requisite for working spots in bobbin-net lace; also, in combining such arranged spotting machinery, with the usual parts of rotary machinery, so that the spotting machinery may be put in action to produce patterns in the lace, by the same rotary impulse which causes the plain net to be made, through the ordinary evolutions of the machinery to which the spotting apparatus is appended; and also in arranging in like manner, the various parts of spotting machinery, so as to dispense with any selection of particular bobbins and carriages, and combining such arranged spotting machinery with the ordinary fluted roller machinery.

Fig 137



The improvements shown in Fig. 137, consist in a method of

combining the spotting machinery with ordinary fluted roller machinery. In fluted roller machinery, no selection can be made of the bobbin carriages, which are to be used in spotting; because all the carriages must go backward and forward, in complete rows; therefore, whilst the spotting is going on, all the warp threads must remain motionless, without shogging, except those particular warp threads which are hooked up to form spots.

To effect the shogging of particular warp threads, four extra series of guides and guide bars, marked *w*, *x*, *y*, *z*, are provided and are applied close against the ordinary guide bars *t*, *t*, in the usual manner of applying extra guide bars, for selvage threads. A racking or shogging motion is given to two of these extra guide bars at each time of spotting. In this arrangement, the pointed wires 6, must have two prongs each, to include between them the warp threads, intended to form the spot; one of these prongs will then bend aside the warp thread included between them, so as to bear it into the hook 1, and keep it securely in the hook, whilst it is going up to the points. The warp threads which are intended to be caught or hooked up, are conducted through the eyes of the extra guides *w*, *x*, *y*, *z*, and are supplied from two extra warp rollers, (unnecessary to show in the drawing,) one to each pair of guides. The warp roller, which supplies the other ordinary warp threads, is shown at S.

The fluted rollers R R R R, which drive the bobbin carriages, are turned by a toothed sector or fan, (in the usual way,) taking into toothed pinions, attached to their extremities. The action is so nearly the same, whether warp threads or bobbin threads are to be taken up, that further explanation is unnecessary.

Mr. Crofts's third invention or improvement in lace machinery consists of, an improved mode of combining together and actuating certain parts of machinery, already known, and used for making bobbin-net lace; by means of which two thicknesses, or tissues, or webs of lace net, may be produced together, in the same machine; that is to say, the lace net which is made in the machines, by twisting together the bobbin threads and warp-threads, after being formed into regular meshes by the taking-up action of the points, is wound or rolled up around the lace roller, as fast as it is made; which lace will consist of two thicknesses, in close contact, the successive rows of meshes of both nets having been gathered up together like one net, by the said taking-up action of the points. When such lace is afterwards unrolled and removed from off the roller, it can be separated into two distinct pieces of lace net.

This improved mode of Mr. C's. may be carried into effect, by parts of fluted bar or fluted roller machinery; *which is so called, because, the bobbins and carriages are moved backwards and forwards in the combs and between the warp-threads, by means of revolving fluted rollers*, the flutes of which act between corresponding teeth, formed at the under side of the carriages, in the same manner as the teeth of pinions act in teeth of cog-wheels; or it may be carried into effect, by parts of circular comb machinery, the bobbins and carriages of which are moved in the combs, by the joint action of what are called *swinging driving bars*, situated above the combs, and lockers, situated beneath the combs, turning on centres; which lockers catch projecting nibs at the under sides of the carriages (see Fig. 234) and draw them out from between the warp-threads into the opposite combs to those from which they have been projected by the previous action of the driving bars.

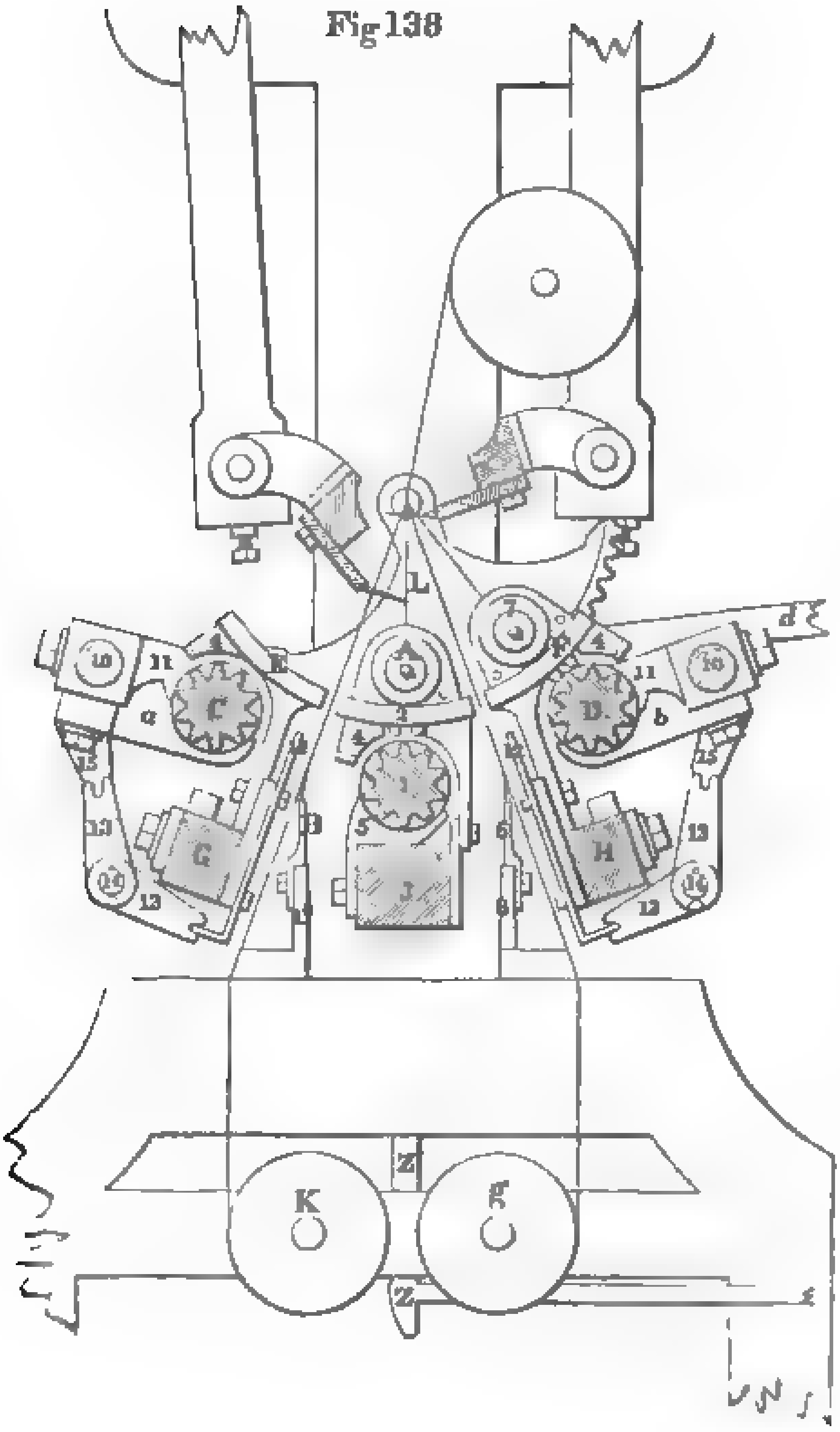
Fig. 138 represents the mode of operating by means of fluted roller machinery. The bobbin carriages A and 7, have teeth at their under parts to be acted upon by the flutes of the rollers C, D, and 1, in order to move the carriages backwards in the combs F, F, and 2.

These combs have tongs, projecting from them at each end, which are cast in leads to hold the combs together, the lead at one end of each comb being adapted to be screwed against the comb bars G, H, and 3, as usual in fluted bar machinery; but the leads 4 4 4, by which the extra tongs, at the opposite ends of the combs, are united, are for the purpose of retaining the combs steadily at their proper distances asunder.

The fluted rollers C, D, and 1, which drive the bobbin carriages, are situated beneath the centres of the combs E, F, and 2, respectively, in the arches which are left between the tongs, and are supported on pivots at their ends, in the usual manner of fluted bar machinery, each roller being steadied in the middle of its length by bearings *a*, *b*, and 5, to prevent it from bending or springing.

The guides B and 6, for the warp-threads, are cast in leads, and are screwed on guide bars 1* and 8. These guides, instead of being close together, as usual in fluted bar machinery, are placed so far apart, that the middle row of combs 2, are included between the two rows of guides, in order that the carriage A or 7, may pass completely out from between one row of warp or guide threads, before the same carriage makes its entrance between the other row of warp or guide threads; whereas, in common fluted bar machinery, the carriages must pass between both rows of warp threads at

Fig 138



once. The guide bars 1* and 8, are capable of shogging endways, in order to rack the warp threads, as usual in other machines. The racking is effected by a lever Z, at the bottom of the machine, actuated by a cam, by which lever the middle comb bar 3, is racked endways when required to produce the traversing of the bobbins.*

* A rack of lace is a certain length of work, counted perpendicularly, and contains 240 meshes or holes.

The bobbins and carriages, combs and guides, are made single tier gauge, instead of double tier guage, as used in common fluted bar machinery.*

The middle fluted roller 1, is supported on pivots at each end, in bearings affixed to the end of the middle comb bar 3, so that it will partake of the racking motion of the middle comb bar: each extremity of its fluted part is provided with what is generally called a "*turn-again*" piece,† of the same kind as is commonly used, at one end of each of the innermost rollers, in ordinary fluted bar machines, for permitting the turn-again of the carriages, that is their transfer from one row to the other, at the ends of their respective rows.

Owing to the short length of the combs, and to their being connected by lead at each end, it would be difficult to take out carriages from the combs when required; therefore, to permit of drawing out the carriages, at the open ends of the combs, the two rollers C and D, are each supported in sockets 11, 11, which are fastened in the manner of short crank bar arms, to each end of the horizontal axles or spindle bars 10, 10, placed parallel to the comb bars. Each of the axles 10, are supported on pivots, so as to be capable of turning a little round, in order to let down the fluted rollers, as much as may be requisite, to disengage them from the teeth of the carriages, in order to set the same at liberty, and permit them to be drawn out at the outer or open ends of the combs. The pivots, at the end of the crank bars, are supported in bearing sockets, which are fastened to the ends of the comb bars; and they may be steadied in their centres by a suitable support, fixed to the middle of the comb bar.

When the fluted rollers C and D are let down, the carriages, must be prevented from sliding down by their own weights in either of the combs E or F, and entangling among the warp-threads. For this purpose the flat bars 12, 12, are slidden upwards against the inside flat surfaces of the comb bars G, and H, to which they are held by screws, passing through upright slots in the bars, and fixed into the comb bars: thus, the bars 12, 12 are enabled to be

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* The term "*gauge*," in the lace manufacture, means the number of gates, slits, or interstices, in one inch of the bolt bar comb.

† The Nottingham lace manufacturers give this part of the machinery the appellation of "*tum-again*," being a corruption of the phrase "*turn-again*."

slidden upwards on these screws, in order that their upper edges may raise the under side of the carriages and stop.

The bars 12, 12, must be raised up to the carriages at the same instant that the fluted rollers are let down; which is effected by a small elbow lever 13, poised upon a centre-pin 14. The lower arm of each elbow lever 13, has a notch or opening in its end, to receive a flange at the lower edge of the bar 12, and the upper arm of the elbow lever 13, has also a notch or opening in its end, to receive a tooth at the end of a short arm 15, which projects out from the crank bar axis 10, and acts in the manner of a short lever to raise up the flat bar 12, by moving the elbow lever 13. When the fluted rollers are raised up again, the bar 12, is withdrawn by the same movements.

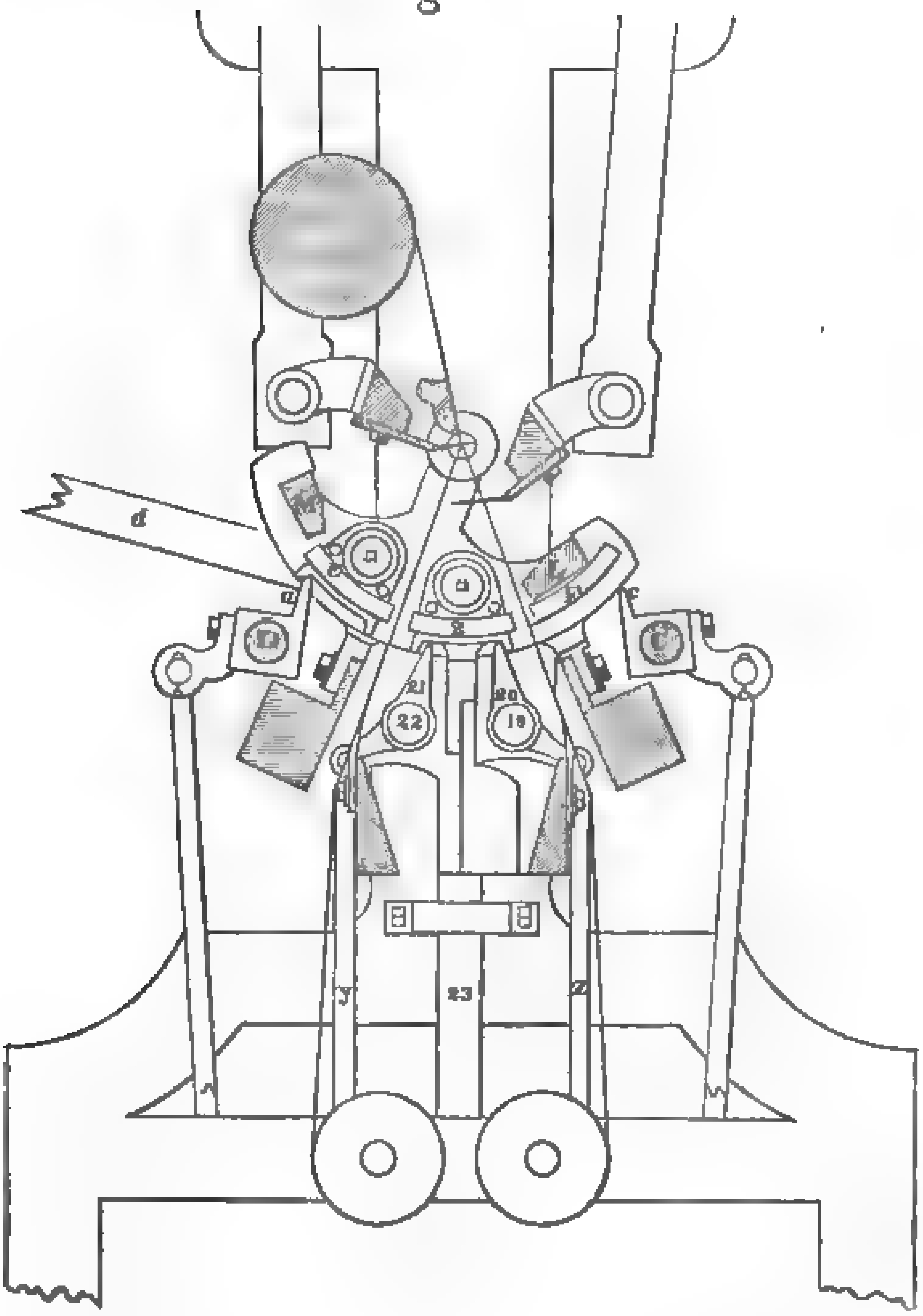
Rotary motion is given to the fluted rollers C, D, and I, by a sector L, taking into pinions at the end of the axle of each roller. The sector L hangs loosely upon one of the main centre-pins, and is moved backwards and forwards, with a vibrating or pendulous motion by means of a link *d*, from the upper end of a lever *behind the machine*, which receives its power from a pair of cog wheels. The warp-threads for both pieces of the double net, may be supplied from one large warp roller, such as is commonly used in other lace machines, instead of the two marked K and *g*.

The mode of operating in circular comb machinery, is shown in Fig. 139. The combs are placed in three rows, as before described, but their shape is a little different, because the lockers, which are to act beneath them, will not permit of having projecting tongs (as in Fig. 138,) at the end of each comb. The middle comb 2, has the tong in the centre of its length, and the back and front combs, have their tongs at their ends.

The form of the carriages is similar to those used in circular comb machines, with two nibs or teeth, at the under side of each carriage for the blades *c*, *a*, of the locker to take hold of (see Fig. 136.)

The lockers C, D, are the same as in common circular comb machinery; and are placed beneath the front and back combs, E, and F, in a suitable position for their blades *c*, and *a*, to catch the outer teeth of the carriages which are pushed into the combs over the lockers, so as to draw out those carriages from between the warp-threads, when the blades of the lockers are turned upwards, but when they are turned downwards, their acting edges descend below the range of the nibs of the carriages and allow the nibs to pass over them. There are, likewise, two other lockers 22, and 19,

Fig. 139



with blades 21, 20, which assist in passing the carriages out of the centre combs; they are raised by the upright sliding rod 23, which supports the sockets of the lockers; *y* and *z*, are links attached to the locking lever.

The driving bars L and M, are the same as are used in circular comb machinery, and act with a vibrating or pendulous motion, to push the carriages along in their combs and pass them beneath the warp-threads, but the driving bars L. M. cannot push the car-

riages quite through the warp-threads: therefore, as soon as the nibs of the carriages, which are foremost, get far enough over the blade of that locker, situated at the opposite side of the warp-threads, then that locker is turned up and its blade will draw those carriages quite through the warp-threads.

The leading features of novelty in this part of Mr. Crofts' machinery consist in combining and arranging certain parts in such a way as to have a middle row of combs, with a row of warp-threads, on each side of those middle combs, whereby one row of carriages may be passed entirely through one row of warp-threads, before the other carriages arrive at the other row of warp-threads; and of actuating the parts of machinery, for making lace, with suitable racking movements to cause parts to make a double web or tissue of lace-net, in the manner herein described; which, when taken out of the machine, can be separated into two distinct pieces of lace-net, by cutting the turn again, traversing bobbin, by which the borders or edges of the piece of double net were united together, during its fabrication.

Mr. Crofts' fourth improvement in lace-making machinery consists in certain alterations or arrangements in the structure and mode of working that class of lace machinery called "*the levers*,"* and the circular comb machinery, for the purpose of making a particular pattern of lace, having large holes in it at certain intervals, called bullet holes.†

In applying this improvement to the lever machine, the parts called pushers, which are used for dividing the carriages into two ranges, together with the pusher-bars, and all their supports and appendages, must be entirely removed from the landing bars; because, in the proposed method of working, no traversing of the carriages will be required. The comb-bar wheel, with its bolt and connections for racking the front comb-bar, must also be removed; the front comb-bar being kept stationary by its gauge screws.

If the machine has been used for making narrow breadths of lace, the turn-again combs and bar are removed, and the back combs cast anew. If it has been used for making only plain net, without bullet holes, the selvage guides are removed from their bars, and their racking wheels also.

The rachet wheel, on the axles of the racking wheels, which has

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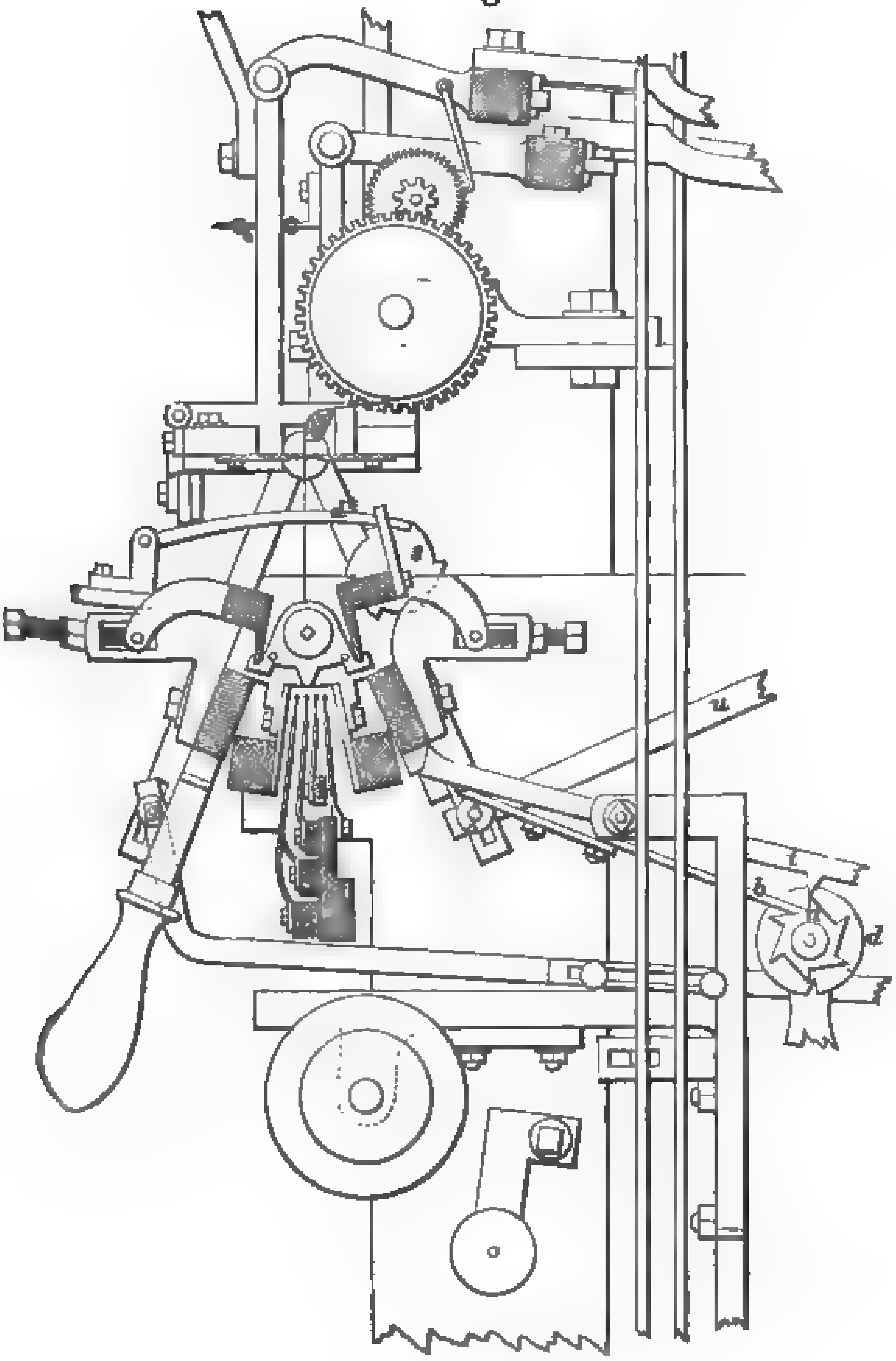
* The machine here referred to (the lever machine) was invented by Mr. John Leavers, of New Radford, in the year 1811.

† See "Egyptian Shebetz," page 46 of Introduction.

eight teeth, must be changed for a new one, with only six teeth; and the guide-bar racking wheel must be removed, and a new one cut, having three steps or elevations on its circumference. The catch-bar wheels, for lifting and letting fall the catch bars, are removed; and others, with three deep notches, are substituted, their ratchet wheels having six teeth. The number of points are to be

Fig. 140



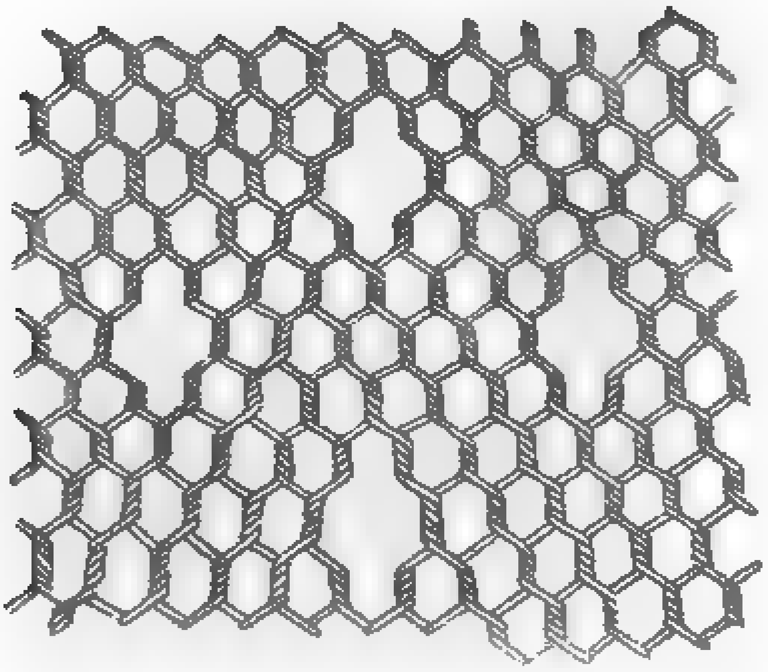
doubled; that is, in what is called a ten point machine, twenty points are placed in every inch.

The pump apparatus or lever, for lifting and letting fall the catch bar when either of the point bars come down and go up again, must be disconnected from both point bars.

Fig. 140 represents a sectional elevation, taken transversely through the machine, for the purpose of showing the forms and positions of the working parts. The ratchet wheel *a*, which usually has eight teeth, must be changed for one of six teeth as in the figure.—This ratchet drives the notched wheel *d*, which governs the half way or dividing stop. This stop must be adjusted, so as to catch and detain the back landing bar *t*, when the two landing bars *t*, *u*, are quite down, or closed together, instead of detaining them at a little distance apart, as in the ordinary positions, for the divided carriages to be caught by the catch bars, in common lever machines.

The large guide-bar racking wheel, must also have thirty-six teeth, and the large racking wheels, for the extra guide-bars, for bullet holing also have thirty-six teeth; none of which parts are shown in the figure, being already well known and in common use. The threads, to form the bullet holes, are provided with the extra guides *m*, *n*, *o*, *p*, which are attached to the usual guide-bar, and each receives a separate racking motion, the bullet holes being formed by the ordinary method. A magnified portion of the lace ornamented with bullet holes, is shown at Fig. 141.

Fig. 141.



The ratchet wheel *a*. affixed to the notched wheel *d*, is

by the driver *b*, and in place of driving-bars and lockers, two catch bars *r r*, are applied, their ratchet wheel *s*, being turned by the driver, *d*.*

The selvages of the net are formed by strong warp threads, stretched tight, provided by a roller, distinct from the warp roller. In applying these improvements to circular comb machinery, the front comb bar is kept stationary, and its racking wheel is removed. The points are also doubled in this machine, being changed from ten points to twenty points per inch. The racking wheels are changed for new ones,—one having eight different projections, and the other five, which are turned by a ratchet wheel of twelve teeth.

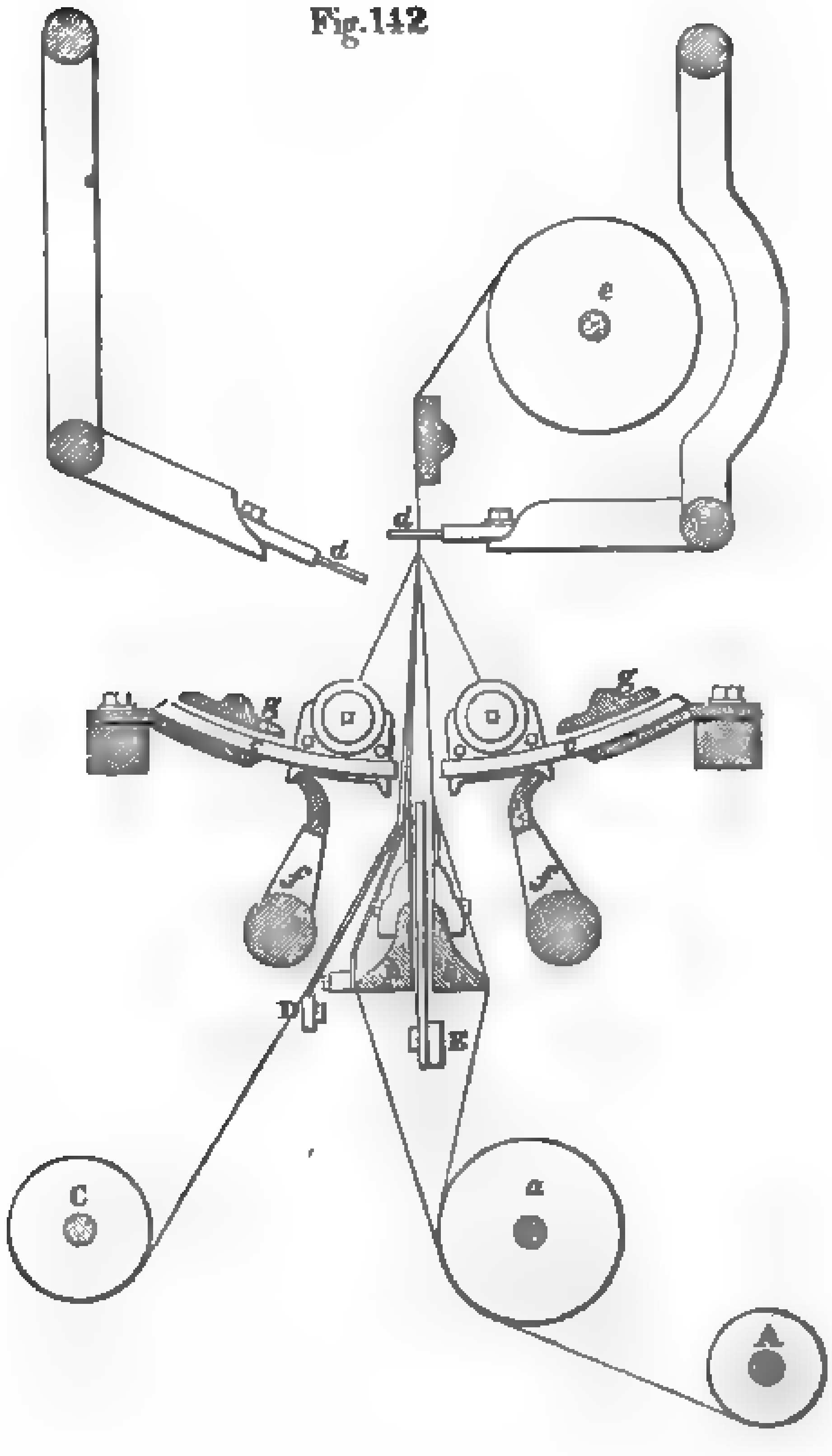
We are informed by Mr. Crofts that this kind of lace-net (see Fig. 141) will be of a much more simple texture than ordinary bobbin-net, being without traversing threads, and therefore can be made more expeditiously.

Having given the reader a faithful description (a practical one) of Mr. Crofts' improvements in lace machines in general, and illustrated the same by suitable engravings, etc. we pass on to describe a few improvements of quite a different character, made by our ingenious and worthy friend, John Heathcoate Esq., of Tiverton. The first of these inventions consists in a new mode of manufacturing bobbin net-lace, by inserting sewing thread between the breadths of lace, during the fabrication and finishing of it. In this improved mode, the lacing thread passes in front of the warp-thread that forms the selvage, and behind the two bobbin threads which compose the meshes of the lace, and then repasses in front of the warp-thread to the adjoining breadth, on which it acts in a similar manner. Another part of the improved mode, consists in ornamenting the lace, by passing the lacing thread round the two bobbin threads, composing the top of the meshes.

Fig. 142 represents, in section, the principal working parts of this machine. *d*, *d*, are the points; *f*, *f*, the lockers; *g*, *g*, the driving bars; *c*, *c*, the combs; *e*, the lace roller; *a*, the warp roller; *b*, *b*, are the ordinary guide bars, with their guides.

The selvage threads are supplied from the roller A, one row of threads passing through the ordinary guides on the common guide bar *h*, and the other row through the guide *b*, which is attached to the guide bar *h*. The ordinary warp-threads proceed from the roller *a*, through the guides on the guide-bar *b*. The bar E, is called the "*poppet bar*," and has a vertical movement, for the purpose of stopping the turn-again carriages, by means of suitable catches on its upper end. The parts by which these improve-

Fig. 142



ments are effected are the guide D, and the lacing thread roller C. The guide D has a separate racking movement from the other guides. The improvement in this part of Mr. H's invention consists in the mode of inserting the lacing thread, by passing it across the warp-threads and behind the bobbin threads; and likewise the mode of ornamenting the lace, by passing the lacing threads round the bobbin threads, which compose the top of the meshes.

The second part of this gentleman's improvements, in lace machinery &c., which we shall now endeavour to explain, consists in a method of manufacturing ornamental work or figures composed

of edgings, neiges, tattings, or narrow stripes, of gauze or of any other suitable fabric, so as to assume new forms and shapes, by being put upon pins, arranged to receivethe same, in curves, angles, circles, or other figures.

The indentation required for producing one pattern, and the form which is given to the edgings in that particular design, by putting them on pins, as shown at Fig. 144, will sufficiently illustrate the nature of the invention; and it will be evident, that by varying the forms of arrangement of the pins, with corresponding or suitable indentations or spaces in the edgings, varieties of figures or patterns may be produced.

The third part of Mr. H's inventions consists in certain machinery, tools, implements, or apparatus, to be used in applying such ornaments, ornamental work or figures.

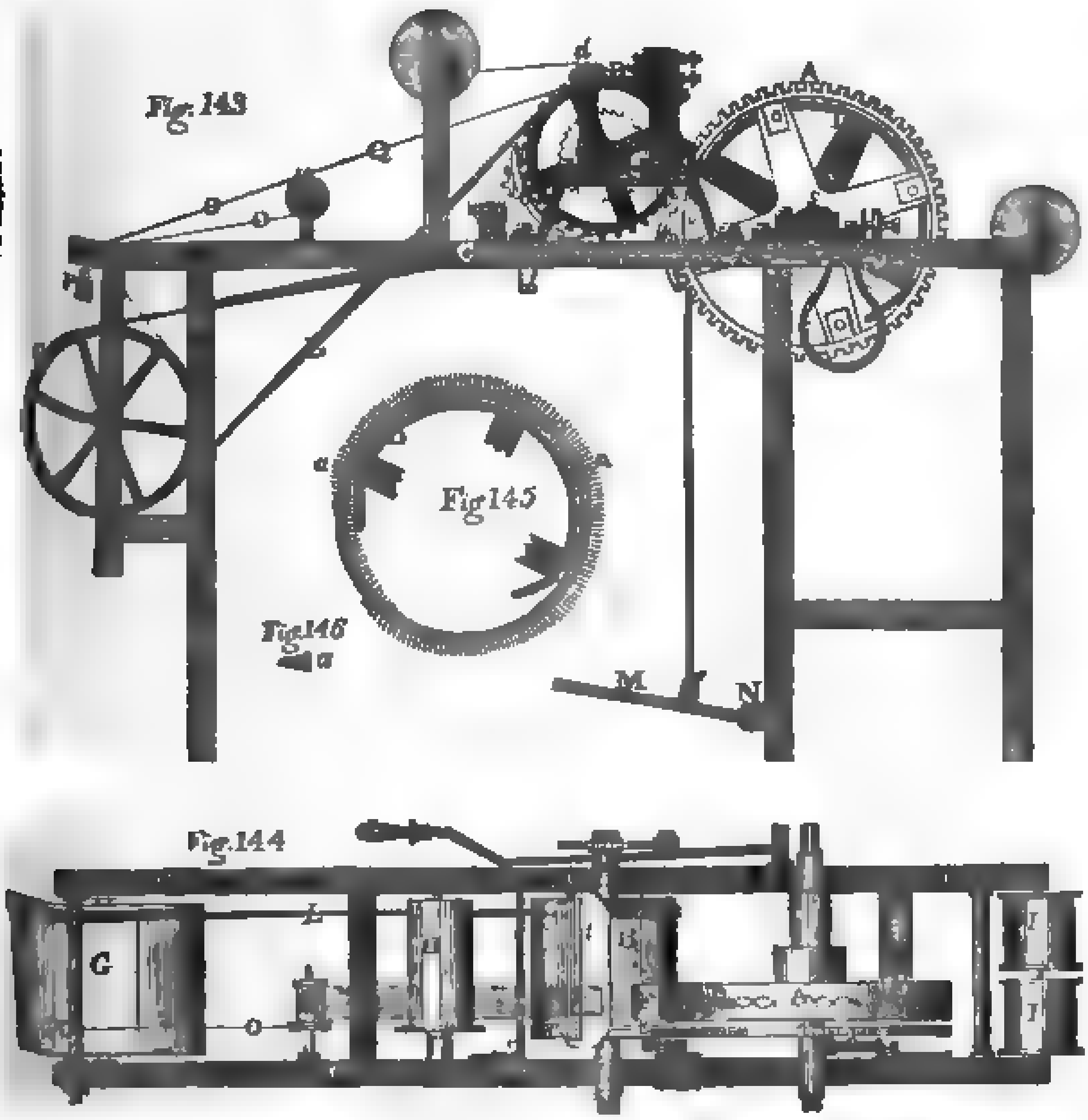


Fig. 143 represents a side view or elevation of the machine, composed of the large cylinder A, and the small cylinder B, and their accessories, mounted upon a frame C. The rim of the large

cylinder is pierced with holes, to receive the pins *a*, *a*, (see Fig. 145 and 146;) which holes are made in curves, or other figures, according to the pattern or design intended to be produced, as will be seen more clearly in the plan, Fig. 144. These pins are sustained by a curved plate D, (see Fig. 143 and 145,) supported from the axis of the cylinder A, within or underneath the upper portion of the cylinder rim A; which plate is so shaped and kept stationary by the brace *e*, as to allow the pins to be pressed back within the perforated cylinder A, as they are successively brought in contact with the small cylinder B; by which means the borders, sprigs, or other figures, are liberated from the pins. As the cylinder A revolves, the pins *a*, *a*, descend by their own weight, whereby the points again project from the cylinder A, and are kept by the curved plate D, in that position, as they move in succession towards the upper part of the circle, as will be best seen detached at Fig. 145.

Upon these pins, the edgings or other texture, (which may be conveniently supplied from the bobbins I I,) is put, and the revolving of the cylinder A, carries it forward towards the cylinder B, which, on its part, draws off the lace-net, or other fabric, from the roller H, and bears it on the upper part of its surface towards the cylinder A.

The surfaces of these two cylinders, A and B, being moved simultaneously and equally, (by means of the wheels, upon their respective axis, working into each other,) the net and the edging or border are brought together, and pressed closely between them: over the small cylinder B, the sizing roller E (see Fig. 143) is made to press upon the net, the surface of the roller being formed according to the figure which the edging assumes upon the cylinder A. (See a sample of edging on the cylinder A, at Fig. 144.)

The cement is applied to the net only where the edging will come upon it when the pressure, just alluded to, causes the edging to adhere to the sized net. The roller E, is supplied with size or cement by a small roller F (see Fig. 144) the under surface of which dips into the trough containing the same (as in sizing warps for power looms; and as the rollers E and F, by the wheels upon their respective axis are connected, and in due proportion with the cylinders A, and B, a proper supply of size is in succession applied to those parts of the net, or other fabric, intended to receive the ornamented border or pattern.

The surface of the roller E, must, of course, be covered with woollen cloth, or other suitable elastic substance, which will yield to

any inequality of the material passing under it. G, is a cylinder to receive the lace; it is moved by a band or belt L, passing over the cylinder B, which it causes to draw the lace therefrom, and to overcome any tendency which it may have to adhere to the cylinder B. But to prevent the lace from being stretched or elongated, and also the better to separate it from the cylinder B, a number of silk threads Q, are passed over the cylinder B, as shown at Figs. 143 and 144. These threads effectually strip the net or lace from the cylinder, and continue in contact with it until the whole operation is completed, and are not separated from it until the lace is taken from the cylinder G. Wet spunges *b*, *b*, (see Fig. 143) are made to press against the left hand side of each of the cylinders A, and B, to take off any size which may adhere to them. Motion is given to the cylinder B, (which by the train of wheels and the band or belt L, communicates it to the other cylinders and the roller,) by a treadle M, acting upon the ratchet-wheel, fixed upon its axis N, or by any other suitable contrivance. *e*, *e*, is a spring governed by a set screw (see Fig. 143) which, by its action against the bearing of the cylinder A, regulates the pressure upon the net and border between the two cylinders A and B.

The trough which contains the size or cement, is regulated, so as to allow a proper quantity to adhere to the surface of the roller F, the excess being retained by the contact or pressure of the side of the trough against it; which, of course, is well understood.

The net or other fabric, *destined* to receive the border, is to be passed alternately under and over the wires *d*, in order to keep it flat and moderately tight. Tension cords O, and weights P, are likewise applied to the bobbin K, and cylinder G, so as to give the required tension to the silk threads Q (see Figs. 143 and 144) and finished work.

For the purpose of better exhibiting the several parts of the apparatus, we have left out the work altogether in the plan, Fig. 144.

It may be useful to add, that the wet spunges *b*, *b*, may be advantageously applied to the surfaces of the cylinders A, and B, by the pressure of levers and springs.

By the term *edgings*, is meant, any suitable stripes of woven or manufactured texture, proper for being formed into figures or patterns; and the term *borders*, is meant to designate such edgings, formed into designs and attached to net, muslin, or other suitable texture.

We have, for the sake of more clearly describing this pro-

cess or manufacture, shown an uninterrupted succession of pattern or design, or borders; but, it is evident, that if alternate intervals or spaces were left between portions of pattern, detached objects of the nature of sprigs, groups, or boquets, may be produced, according to the taste of the designer, and the consequent arrangement of the pins *a*, *a*, and the roller E, by which the gum or size is applied to the net.

If the object be to produce *imitation of Brussels lace, or Honiton sprigs*, the edging must be made of such forms and materials as will, when formed and pressed into the proper shapes, most nearly resemble the work made by the hand with the bobbins or needles; and the method of sewing them to the net, which is practised with regard to the Brussels and Honiton sprigs may be adopted; and also in imitation of Chantilly and other blonde laces, in case it should be deemed necessary.

The pins *a*, *a*, (one of which is shown enlarged, at Fig. 146) are suitable where the edgings have holes or open places, by which it can be readily put upon them; but in case the edging is of a close texture, the pins must be smaller. The size or cement may be made of various kinds of gum, or other adhesive matters. Gum-arabic, dissolved in water, and of the consistence of thick cream will answer the purpose very well.

We shall now conclude this part of our subject, by laying before our readers a copy of a letter, containing an account of the specimen of ancient Egyptian lace or net, to which we alluded in the introductory part of this Work. (See page 46.)

A representation of this specimen is given at Fig. 147; which we think demonstrates, beyond the possibility of a doubt, that the lace machinery used by the ancient Egyptians, must have been brought to great perfection indeed, before such a fabric could have been produced. But the following letter, from Mr. Kersivenus, will convey a better idea of the subject than anything we can say.

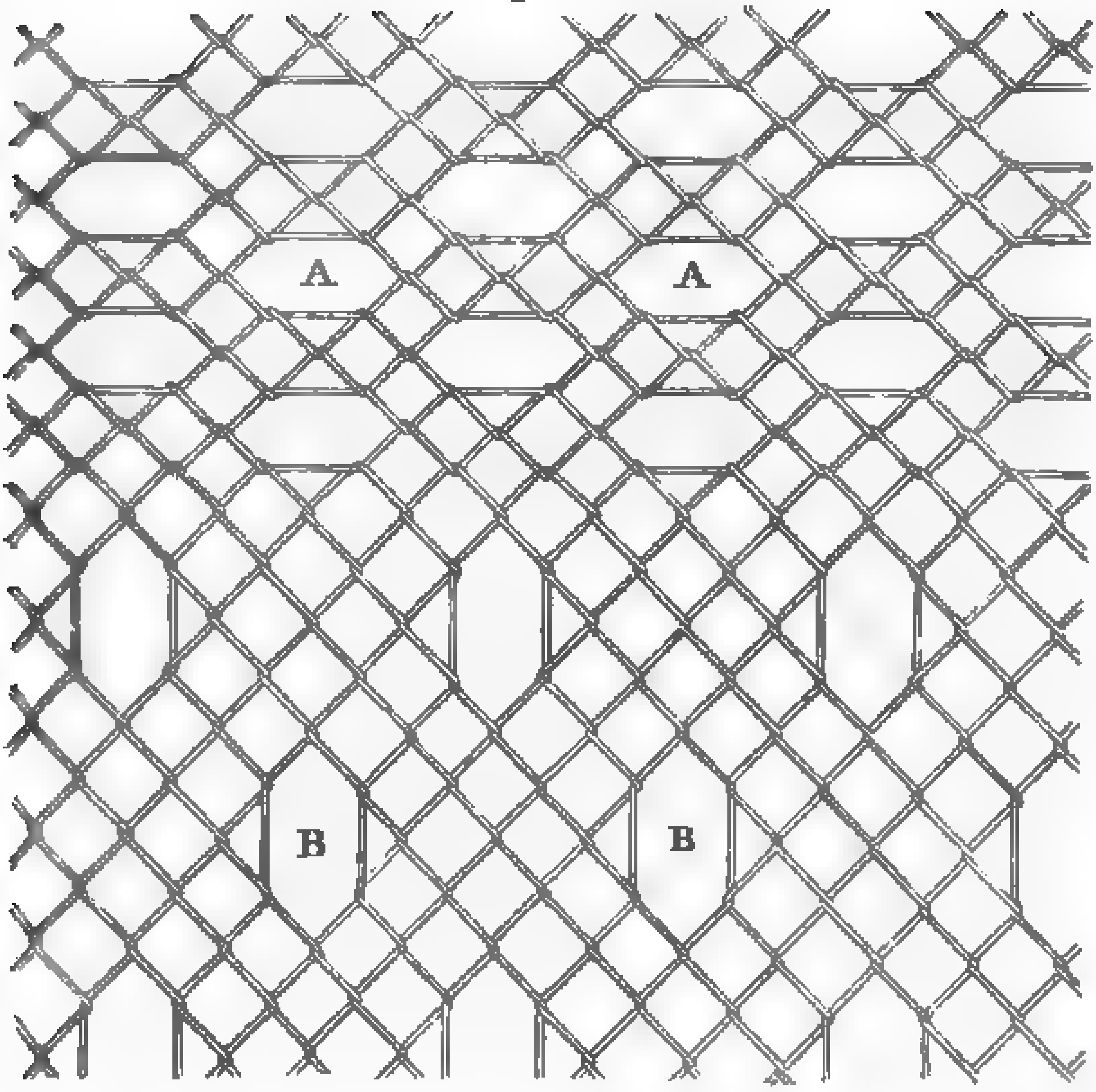
Thebes, October 17th, 1843.

Dear Friend,

Your favour of the 19th May last, was handed to me last evening, by our worthy friend Amasis Osirtasen, who arrived here yesterday morning, on business of importance for his Majesty.

With regard to what you say about the sample of lace or net, it is lucky indeed, that your letter reached me in this place; because I am thus enabled to furnish you with a drawing of it, and

Fig. 147.



also some explanation, more easily than I could otherwise have done.

On receipt of your letter, I lost no time in calling upon our esteemed acquaintance, Lepsius, who very fortunately happens to be here at present; and after mentioning to this scientific gentleman the object of your letter, he at once consented to aid me in searching for the sample, as he says, that he feels interested in your success, and has done so, ever since he first saw you in Berlin, while you were there in 1833, obtaining a patent from the Prussian Government, for a carpet power loom, with what the Doctor calls, '*lunar detached revolving shuttle boxes.*"

We proceeded this morning, a few minutes before sunrise, at which time we commenced our search; and we continued it without intermission until 10¼ o'clock A. M.; at which time we had given up nearly all hopes of success; and, in fact, were just at the point of leaving the scene of investigation, when fortunately the Doctor's eye (which you know is always on the sharp look-out)

caught a glimpse, while looking over my shoulder, of the very identical object of which we were in search. You may guess how overjoyed the Dr. and I became on making this re-discovery,* not only for your sake and for that of your country, but also for the interest of *science*, which you are aware is always a favourite hobby with the Doctor. We proceeded forthwith to make the necessary drawing; and, although the sample has become much obliterated from age, yet, with the help of the Dr's. excellent triple lenses (which you know possess most awful powers of penetration) I have been enabled to make a tolerably correct outline, and, in fact, as a whole, not a bad drawing.

You will not fail to perceive, that the part of the sample marked A A in the figure, differs very materially from that shown at B B; and although this feature appeared to me, at first sight, as quite a simple circumstance, our learned friend, who is deeply skilled in the mysterious art of weaving, is of opinion that no machinery at present used in the lace manufacture is at all capable of producing the same effect: he, therefore, concludes, that some very ingenious piece of mechanism, unknown to moderns, must have been employed in the manufacture of this specimen. It will be seen, on close examination, that the same threads which form the weft in the part A A, constitute the warp at B B: this actually puzzles the Doctor, and is, no doubt, worthy of your attention as a practical weaver and manufacturer.

Lepsius tells me, that each thread of the net, although fine of itself, was composed of 598† other threads, all distinct; the quality of the fabric being similar to that of the corslet dedicated to Minerva, at Lindus, by Amasis, King of Egypt. This explanation, he was enabled to decipher, by the aid of one of his best glasses, from a few *obliterated* characters; which, on the closest examination with the naked eye, I was unable to perceive.

The Doctor entertains strong hopes of becoming, in the course

* It appears that Mr. Kersivenus saw this specimen while at Thebes, in the month of March 1835, and of which circumstance he at that time made mention to us in a letter; but being hurriedly called away, on business of importance, he lost all recollection of the occurrence.

† Sir Gardiner Wilkinson, in his interesting work, entitled, "Manners and Customs of the Ancient Egyptians," gives us an account of a corslet, of linen, ornamented with numerous figures of animals, worked in gold and cotton. Each thread of the corslet was worthy of admiration; for though very fine, every one was composed of 360 other threads, all perfectly distinct. See vol. III, page 127.

of a short time, possessed of the machinery by which nets of the kind here represented were manufactured; and, judging from the rate at which excavations are progressing, at present, in this neighbourhood, I, myself have little doubt that his most sanguine expectations will be realized. No farther back than yesterday, about 5½ o'clock P. M., some of his workmen dug up an electrical machine, bearing the name of that ingenious but ancient individual, Tubal-cain; and this instrument according to the Doctor's statement, is the only thing of the kind preserved from the wreck of the anti-diluvian world, Shem, (the first son of Noah,) having taken it with him into the Ark.

Lepsius employs, in these *excavating operations*, a kind of people called "*Irishmen*," and from what I can learn regarding them, they are famous for making headway in this kind of work: each one, of whom, I am sure, is at least worth eleven of my own countrymen.*

And now, Dear Friend, while owls by night, with mournful scream, rouse echo from her idiot dream, may I your humble servant be.

ALEXIS KERSIVENUS,
Civil Engineer,
Homeopathic Physician, &c.

P. S. My family are all well. Cleopatra sends you her love, and three * * * * * !

EMBROIDERY.

"Here the needle plies its busy task,
The pattern grows; the well-depicted flower,
Wrought patiently into the snowy lawn,
Unfolds its blossom; buds, and leaves, and sprigs,
And curling tendrils, gracefully dispos'd,
Follow the nimble finger of the fair:
A wreath, that cannot fade, of flowers that blow
With most success when all besides decay."—COWPER

Embroidery is the art of adding to the surface of woven textures, a representation of any object we wish to depict, through the medium of the needle, threaded with the material in which the

* It may be well to state that Mr. Kersivenus is an Egyptian by birth; but received his professional instruction in France; where we first had the pleasure of forming an acquaintanceship with him.

work is to be executed. This may be effected by various methods, and on most descriptions of fabrics.

Our object at present is, not to enter into a general description of the different articles used by ladies for the purposes of needle-work, nor the methods of applying them. Indeed, the fair sex cannot expect from us any practical information upon such subjects as, *fern-stitch*, *finny-stitch*, *old-stitch*, *new-stitch*, *chain-stitch*, *braid-stitch*, *queen-stitch*, *Spanish-stitch*, *rosemary-stitch*, *whip-stitch*, *back-stitch*, *side-stitch*, *Galway-stitch*, *Kilkenny-stitch*, *Limerick-stitch*, and *Tipperary-stitch*, we shall therefore, confine ourself to giving our readers a brief historical account of the art; and a description of the application of machinery to it, as successfully accomplished by the ingenious M. Josué Heilmann, of Mulhausen, France.*

We are indebted to the luxury and magnificence of the nations of the East, for the invention of embroidery,—an art that has not inaptly been termed the mother of painting, its discovery claiming the priority by many centuries. In more modern times, it has been called the humble sister of the latter art; and the aim of the needlewoman has been to imitate, as closely as possible, the productions of the pencil, a labour in which she has been assisted by some of the most celebrated masters, many of whose chef-d'œuvres have been executed for the express purpose of being copied in needlework or tapestry.

The Greeks gave the honour of the invention of embroidery to Minerva: by Pliny it has been assigned to the Phrygians; hence he says the Romans called embroiderers "*Phrygiones*," and embroidered garments, "*vestes Phrygioniæ*." The women of Sidon, before the Trojan war, were especially celebrated for their skill in this art: and Homer mentions Helen as being engaged in embroidering the combats of the Greeks and Trojans:

"An ample web magnificent she wove,
Inwrought with num'rous conflicts for her sake,
Beneath the hand of Mars endured by Greeks."

Andromache also—

"She in her chamber at the palace top,
A splendid texture wrought, on either side
All dazzling bright with flowers of various hues."

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* Those of our readers who wish to obtain a knowledge of this art, as practised by ladies, are referred to Miss Lambert's excellent "Hand-Book of Needlework."

The art of embroidery was greatly practised among the ancient Egyptians; even the sails of some of their ships were wrought with fanciful devices, representing the phenix, flowers, and various emblems.* In the time of Moses, Aholiab, the son of Ahisamach, of the tribe of Dan, was celebrated as "a cunning workman," and as an embroiderer in blue, in purple, in scarlet, and in fine linen.† The curtains and ornaments of the Tabernacle, and the vestments of the priests, were decorated with embroidery. The prophet Ezekiel, reproaching the women of Israel with having abused the benefits of Providence, after mentioning their bracelets and chains, jewels for their foreheads, and earrings, and their crowns, still farther names their robes, dyed and embroidered of divers colours.‡ Attalus, king of Pergamus, is said by Pliny, to have invented the art of embroidery with gold thread.

According to Diodorus Siculus,§ Zaleucus, a disciple of Pythagoras, and a lawgiver of the Locrians, forbade the use of embroidery, except to courtesans: and Dionysius Halicarnassus‖ informs us, that Tarquinius Priscus, who first distinguished the monarch and senators by particular robes and ornaments, was the first Roman king who wore an embroidered garment.

The term embroidery, as employed in the writings of the ancient historians, has reference to all kinds of ornamental work done with the needle; thus comprehending within its meaning every description of decorative needlework, including tapestry and some descriptions of weaving. At the present day, the term is much more limited, relating to one kind of needlework only, which, however, embraces an almost innumerable variety, both as to the materials employed, and the mode of using them. In the extended meaning of the term, therefore, nations and savage tribes unknown to the ancients, may equally claim the honour of a similar invention, as most of them have a species of embroidery peculiarly their own.¶

* Cloth, of embroidered linen, appears to have been made in Egypt expressly for sails, and was bought by the Tyrians for that purpose (Ezekiel xxvii. 7,) but its use was confined to the pleasure boats of the nobles, or of the king himself; ordinary sails being white. We are informed by Pliny (lib. xxx. c. 1.) that the ship in which Antony and Cleopatra went to the battle of Actium was distinguished from the rest of the fleet by its purple sails, which were the peculiar privilege of the Admiral's vessel.

† Exod. xxv. 35. ‡ Exekiel xvi. 13. § Lib. iii. c. 62. ‖ Lib. xii. p. 299.

¶ The word embroidery is derived from the French *broderie* which some deduce by transposition from *bordeur*, because they formerly only embroidered the borders of their stuffs, whence the Latins sometimes called embroiderers

The Chinese have long been celebrated for the beauty of their embroideries; indeed, it has been doubted whether the art was not originally brought into Europe from them, through the Persians. They use floss and twisted silks, also the bark of a tree spun into a fine thread.* The drawing of their embroideries is sometimes as uncouth as that of their paintings, but in that of some of their flowers (doubtless copied from nature) they are frequently even botanically correct; and their works are not more to be admired for their remarkable freshness than for the extreme labour bestowed upon them. Success, as gained by patient application, is nowhere so frequently exemplified as in China. The mere accomplishment of writing a good style, is the result only of many tedious years of study and self-denial. The beauty of the written character, the finished graces of their composition the excellence of their silk manufactures and embroidery, the wonders of their porcelain, and many other marvels in art and knowledge, are the natural results of untiring industry and perseverance. A Chinese uses no short cuts, resorts to no compendious methods for abridging labour:—he is not without ingenious resources to accomplish an end, but his aim does not seem to be to save time.

We are indebted to Mr. Tradescant Lay for the following interesting account of the art of embroidery as at present practised by the Chinese. "For twenty-two cash or tseen," he says, "I purchased an elegant book, filled with choice subjects of the graphic art, as patterns for the use of the young needlewoman. She is assumed to be poor, and hence the little manual is priced at about one penny of our money. It has a cover of a fair yellow, studded with spangles of gold, and contains between two and three hundred figures, culled from the varied stores of nature and art. In fact, the objects are so well selected and so numerous, that they might serve as illustrations to a small encyclopedia. One acquainted with Chinese literature and natural history, might deliver several lectures with this book before him. The meadow, the grove, the brook, the antiquary's museum, and the pages of mythology with the adornments of the house and garden, are all laid under contribution.

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limbularii. According to Du Cange, they anciently wrote *aurobrustus*, for embroidered with gold, or *brustus brodatus*, whence the French word *broderie.*

* The fine muslins made at Manilla, with threads spun from the pine-apple plant, and afterwards so richly and delicately embroidered with the same material, are well known.

The book is said to be for the use of the person who belongs to the *green window*, which is an epithet for the dwelling of a poor woman: while the *red gallery* denotes the residence of a rich female. The industrious poor plies her task near the green lattice, which is made of earthenware, and lets in both the light and the breath of heaven; while the rich dame leans upon the vermil-tinted balusters of the gaudy verandah, and gazes carelessly at the sunbeams as they sparkle among the flowers or woos the soft breeze which agitates the green roof of the Indian fig-tree. The title-page presents us with a venerable man, in the weeds of office, holding in his hand a scroll with this motto, 'Heaven's magistrate confers wealth.' Over his head are bats disporting among the clouds; the emblems, I suppose, of wakefulness, for these animals are on the alert, while men sleep. 'Her candle goeth not out by night,' is what Solomon tells us of the needle woman, whom he eulogizes in the last chapter of Proverbs. I once saw two girls at this work in the village of Mongha. They were seated upon a low stool, and extended their legs across another of twice the height of their seat. In this way a support was provided for the frame on which the piece to be embroidered was spread forth. Their faces wore a sickly hue, which was owing, perhaps, to close confinement and the unnatural position in which they were obliged to sit. The finest specimens of embroidery are, as far as my observation goes, done by men, who stand while at work—a practice which these damsels could not imitate, as their feet were small. They were poor, but too genteel, in their parents' idea, to do the drudgery of the humble housewife, and so their feet were bandaged and kept from growing beyond the limits of gentility. Their looks were not likely soon to attract a lover, and hence they were compelled to tease the sampler from the glistening dawn till the dewy eve. Much skill and labour are bestowed on the embroidery of a plaited skirt worn by ladies, which, with my partiality for what is Chinese, I think without a rival for beauty as an article of female attire. In the little work before me, several patterns are given expressly for this purpose. A curious purse worn in the girdle of Chinese gentlemen, is also the subject of much of this kind of elaboration. Embroidery and figured textures were generally in favour with the ancients, so that the discovery was thought worthy of a superior agency. In the Old Testament we have two kinds, the *maase rokem*, (*opus phrygionicum*,) in which the figures were inserted by the needle; and the *maase choseb*, (*opus plumarium*,) in which they were wrought in the weft. The Chinese are fond of retaining what is

old, and have preserved both these arts in their highest state of perfection."

The beautiful embroideries on muslin, with cotton, by the Indian and Candian women, are well known. The embroidery practised by the latter is curious enough: they work with their own hair, as well as that of animals, with which they make splendid representations of flowers, foliage, &c.: they also insert the skins of eels, sea serpents, banshees, mermaids, and other *outlandish* kinds of fish.

According to M. de Busson, the negresses of Senegal, before their marriage, embroider the skins of various beasts, representing figures, flowers, and animals, in every variety of colour; and the pictures thus formed, they present as trophies of their skill to their husbands, on the morning (before sunrise) of the *ninth* day after marriage: this curious custom appears to be almost universal among the *lower orders*, but it is not so prevalent in the *refined circles*.

The Georgians and particularly the Turkish women, are renowned for their embroideries on the lightest and most delicate materials, such as crape and gauze, which they ornament with gold thread in a manner unequalled. Their embroideries on morocco leather have long been esteemed, on which they work the smallest objects in *gold passing*, without fraying the thread, in a way we cannot imitate. According to M. Savary, they formerly often ornamented their embroidery with pieces of money, the value of which they did not appear to understand; a circumstance, however, which the Genoese merchants, who had a considerable trade in the Levant, turned greatly to their advantage, as valuable and interesting coins and medals were frequently found in the old garments in which they sometimes trafficked. Besides the Turks, the Greek women of the present day, and the inhabitants of the islands of the Levant, are still celebrated for their embroidery, principally of gold and silver. The women of Therapia on the Bosphorus excel in a most beautiful description of work; it can scarcely, however, be termed embroidery, being rather a species of exquisitely fine netting. They represent flowers in relief, every petal of which is worked with the utmost exactness. These extraordinary productions of the needle, unfortunately but little known in this country, cannot be sufficiently admired for their extreme delicacy and elaborateness.

In the last and preceding centuries, when embroidery, as an article of dress both for men and women, was an object of considerable importance, the Germans, but more particularly those of Vienna,

disputed the palm of excellence with the French. At the same period, Milan and Venice were also celebrated for their embroidery; but the prices were so extravagantly high, that according to Lamarre, its use was forbidden by sumptuary laws.

The art of embroidery seems to have attained a higher degree of perfection in France, than in any other country;—it is not, however, so much practised at the present day. Embroiderers formerly composed a great portion of the working population of the largest towns; laws were specially framed for their protection, some of which would astonish the work-people of the present day. They were formed into a company as early as 1272, by Etienne Boileau, Prévot de Paris, under their respective names of "Brodeurs, Découpeurs, Egratigneurs, Chasubiters;"—their last statutes were framed in 1719.

In Saxony, embroidery on fine muslin and cambric has been carried to great perfection. In the neighbourhood of Ebenstock, and the Erzgebirge, much tambour work is done; this is generally sold at the Leipzig fairs, where it is bought by the Russian and West Indian merchants; great quantities are also exported to Persia. At Plauen, in the same neighbourhood (celebrated for its manufactures in linen, cotton, and muslin,) much figured lace is also worked, which may be met with at the shops in Dresden. The embroideries of Nancy and Paris of this description, have of late years attained great excellence, and are much sought after.

Embroidery, on an extensive scale, is often effected in the Jacquard and draw looms. In such cases, front headles are employed; and two beats or strokes of the reed are given to each thread of weft thrown across the web. When there are several colours in one line of the pattern, (as in Fig. 70,) there must be one card or lash to each, to enable the weaver or weavers to embroider them, one colour after another; which he does before giving the two ground beats or strokes of the reed. Embroidered fabrics for covering furniture, are always worked with front headles, for the purpose of binding the embroidery, and the threads of warp which pass through these headles are sometimes taken from the ground warp, and sometimes from an extra warp, accordingly as it happens that the embroidering shades are the same as those of the ground warp, or different from them. Small shuttles or pirns (sometimes called *circles*)are used; a correct representation of one of which is given at Fig. 136. The ground headles are worked for the ground strokes, and the binding headles only are used for embroidering. In most

instances the weaver works the ground headles with his right foot, (as in damask weaving,) and the binding headles with his left. When the pattern requires a great variety of shades of colour the workman places the design paper before him, (as in Gobelins tapestry weaving,) so as to see distinctly how to insert them. When there is any gilding of gold or silver used in embroidering, (which is often the case,) the cloth must be carefully rolled in paper, as fast as woven, to prevent the gilding from injuring the cloth: this is effected by putting clean paper between the cloth and the roller on which it is wound. Each colour in the pattern requires a shuttle for each repeat in the breadth of the web, so that the whole number of shuttles employed is often very considerable. The embroidering shuttle or pirn is generally about $1\frac{1}{8}$ inches in diameter, and $\frac{3}{16}$ths of an inch thick, with a hole in its centre, (as in Fig. 136,) for the carriage pin on which it revolves, as fast as the thread is wanted: its inside is hollowed out to about $\frac{3}{4}$ths of its whole diameter to receive the warp.*

It would have been supposed, that embroidery could never have been worked with profit by machinery; yet, such is the case. But a few years since, M. Josué Heilmann, of Mulhausen, France, invented a machine by which a female, with the assistance of two children, could turn off daily as much work as 20 expert hand embroiderers, employed upon the common frame. An account of this remarkable invention will, therefore, be interesting to many of our readers.

Mr. H. exhibited his embroidering machine in Paris, at the "National Exposition of the Products of Industry," for 1834; and of all the specimens of ingenuity there displayed, it was, without doubt, that which attracted most attention, for whether at rest or in motion, it was always surrounded by a crowd of curious persons; some directing their attention to the embroideries which it had executed, and others trying to follow its motions and to divine its mechanism. Indeed, it was interesting to see, in a small compass, 130 embroidering needles, each busied in copying the pattern, and accomplishing its task with perfect regularity; one person only being required to put all these needles into action. The spectator was especially struck with admiration, in seeing the precision with which each of the needles came of itself to prick the stuff in the very place where the most expert hand would have done it.

Mr. Heilmann has, in the construction of this machine, overcome, in a mechanical point of view, difficulties of an almost in-

* In some instances, the common shawl shuttle is used instead of the circle.

surmountable character ; and he well merits the compliments which he has received.

It is not necessary that we should enlarge upon the national advantages which must result from this invention, because, they will appear obvious to every reflecting mind. .We would remark, however, that it is calculated to supply us with beautiful embroideries, for home consumption, at least, and render us independent of foreigners in this delightful branch of industry, saving millions of dollars annually to the country.

Mulhausen, August 5th. 1843.

Dear friend,

Your favour of the 29th June last has just reached me, enlosing a Copy of " Ure's Dictionary of Arts, Manufactures and Mines ;" in which publication, at page 437 of vol. 1, a catch-penny description of my Embroidering Machine is given : but as all the movements and mechanical arrangements contained in plate 2, of your drawings, with many essential parts of plate 1, are omitted, I have come to the conclusion that the Doctor's description is not intended to benefit the manufacturer or mechanician, in a *practical point of view*, but only for the amusement of children.

I am glad to hear that you have embarked in the publication of a treatise on the art of weaving, which will include all its various branches. Such a work, I am persuaded, will prove of immense benefit, not only to individual manufacturers and weavers, but also to your own country and the world at large ; for in this age of charlatanism, when effrontery usurps the place of genius, a real practical work like that you name, will be quite a god-send ; and you have my best wishes, with those of your friends here, in the undertaking.

" Facts truly stated are the best applauses, or the most lasting reproaches."

I have not made any improvement on the Embroidering Machine for some time past ; nor has there been any material alteration made in its principles, so far as I am aware, either here or in England, since its first introduction.

The patents obtained in France and England, have expired but a short time since, so that this invention, which has really procured me many compliments (among which is the decoration of the " *Legion d' Honneur*") is at present public property.

During the course of last year, I several times visited the factory of Mr. Louis Schwabe, of Manchester, containing 15 of my Embroidering Machines. This manufacturer has received compliments at least sufficient to drive a man crazy, (*Ce manufacturier a recuilli des compliments, à faire tourner la tête*,) from a multitude of persons, who were in Manchester last year, at the meeting of the British Association.*

Although this invention has filled the mechanical world with wonder, I do not think that it has turned much to the pecuniary advantage of those who have hitherto adopted the use of it; but my opinion is, that it will be more serviceable when within the reach of every one.

When your work on the "manufacture of textile fabrics" is ready, you would do well to send a copy of it to our *Société Industrielle* here. It would certainly be received with much favour; and, perhaps, might prove greatly to your advantage.

Je vous présente mes salutations cordial

JOSUÉ HEILMANN,

Membre de la Legion d' Honneur.

MONS. C. G. GILROY,

The price of a machine containing 130 needles, and of course, 260 pincers or fingers to lay hold of them, is 5000 francs (nearly 200*l* Sterling.) Each machine, as before observed, is calculated to perform daily the work of 20 expert hand embroiderers; and it requires merely the labour of one adult, and two assistant children.

The operator must be well instructed in the use of the machine, for he has many things to attend to at the same time: with one hand, he follows the drawings with the point of the pantograph; with the other, he turns a handle, to prick and draw all the needles, which are held fast in pincers, and carried by carriages, approaching to and receding from the web, rolling all the time along an iron railway; and lastly, by means of two pedals or treadles, on which he bears alternately, with one foot and then the other, he opens the 130 pincers of the first carriage, which must give up the needles after having pricked them into the stuff, and he shuts at the same

* We think these compliments have been altogether misplaced. Would it not have been more becoming in these gentlemen, to have sent Mr. Heilmann, the inventor of the machine, a handsome gold medal, in token of their admiration of his ingenuity?

time the 130 pincers of the second carriage, which must receive them and draw them back afterwards. The children have nothing else to do, but to change the needles when the threads are used up, and to watch that no needle misses its pincers.

We shall endeavour to make all the details of this machine perfectly understood; because, it is not less remarkable for the arrangement of the parts which compose it, than for the effects produced.

We shall describe successively,

1st. The arrangement of the frame,
2nd. The arrangement of the stuff,
3rd. The arrangement of the carriages,
4th. The arrangement of the pincers.

ARRANGEMENT OF THE FRAME.

The frame is of cast iron; the parts must be strongly fixed together and set on a foundation firm enough not to be shaken, either by the motion of the machine itself or the movements of the girls, who go from one pincer to another to change or fix the needles. Fig. 1, represents an elevation taken in front of the machine, and Fig. 2, an elevation taken from the left hand side of the machine (as you stand in front of Fig. 1,) In Fig. 2, the side of the frame forms two equal rectangles A B B A, A B B A, symmetrically placed, one at the right, the other at the left hand (as you stand at the side of the machine), and united in the middle by a third rectangle, narrower and more elevated, A D C A.* This assemblage of the three rectangles, forms but one piece or casting;† the sections of the horizontal and vertical sides of the machine are quite similar: on the right hand side at No. 1 (plate 2) is shown a section of the frame, and below it, is represented one of the feet *a*, which has a hole to receive a fastening screw, by which it is secured to the ground. The other side of the frame, which is not represented in

* If the reader will carefully examine the central or middle rectangle (of Fig. 2) he will find that it presents a complete edge view in elevation of the left hand side of Fig. 1, being that side on which the machine is worked, as the position of the pantograph denotes; the letters of reference in the edge or central rectangle Fig. 2, correspond to those of the pantograph or left side of Fig. 1.

† It would be desirable to cast the sides of the frame in one complete piece, as it would save much labor in the fitting up.

he figure, is entirely similar; we shall designate corresponding parts by the same letters of reference with an accent: thus, A′ B′ B′ A′, A′ B′ B′ A′, will be the two symmetrical rectangles of the second end of the frame, A′ D′ C′ A′ will be the rectangle of the middle, corresponding to A D C A, and *a′* will represent the six feet (see Fig. 2) corresponding to those designated by *a*. Between each foot and its correspondent *a′* there is a bar of cast iron A″, the form and disposition of which is shown in Fig. 1. Thus, at the under part, the two sides of the frame are joined by six bars, similar to the bar A″; besides, at the two extremities of each of these bars, there are knees *a″*, to give strength to the frame, two of these knees are shown in Fig. 1: at their upper part, the two sides of the frame are joined by a single bar D″ (Fig. 1,) which has the form of a trough; and is fastened by a nut and screw to the corresponding angles D and D′. Fig. 3 represents at its upper part a section of this bar; Fig. 1, shows the form of its outer edge, as well as that of its back, which is represented by a dotted line.

Such is the disposition of the frame, which bears all the mechanism of the machine; and it is necessary to possess an exact idea of it, in order to understand how the other fixed parts are supported; and how the moveable parts, which are here very numerous, are enabled to perform their respective functions with perfect regularity.

The width of the machine depends upon the number of pincers intended to be set to work. The model which we saw at the exhibition in Paris, contained 260 pincers, and was 2½ metres wide (about 8 feet 4 inches of our measure.) The figures here given have been narrowed considerably, but the other proportions are not disturbed. In our drawings (Figs 1 and 2) the bars A″ and D″, which connect the sides of the frame A and A′ together (see Fig. 1) instead of being 2½ metres long, are not quite 2 metres, (see scale at foot of Fig. 2.)

The length of the frame must always be the same, whether the machine be wide or narrow, for the length of the thread that can be put in the needles, depends upon the length; and it is always advantageous to give the frame, as we have done, all the length adopted by M. Heilmann, that is to say, a little more than two metres, so that the needles might bear a thread one metre long.

ARRANGEMENT OF THE STUFF TO BE EMBROIDERED.

We have already observed that the pincers which carry needles, present themselves always at the same point, and that

sequently, the needles would pass and repass continually through the same hole, if the stuff was not displaced with a precision, sufficient to present successively, opposite the point of the needle, all the points through which the needle has to pass, to execute the flower or the drawings intended. The disposition of the stuff and the mechanism by which it is displaced, to the requisite extent, after the needle has gone through, are therefore of great importance, and we shall try to explain them.

The stuff is set on a large rectangular frame, the four sides of which are visible in Fig. 1, viz: the two vertical sides at F, F; and the two horizontal sides, the upper and the under, at F′, F′.

Fig. 1, shows also two long wooden rollers G, G, the extremities of which, fastened with iron trunnions, bear on the sides F of the frame, on which they turn. These two rollers form a *system of beams*, on which the stuff destined to be embroidered, may be rolled and stretched vertically to the proper degree, for each of these beams has at one of its extremities a little ratchet wheel *g*, *g*; the teeth of one of these wheels being bent in a contrary direction to the teeth of the other, as indicated in Fig. 3, it follows, that in raising, for instance, the catch of the upper wheel and turning the beam in the direction indicated by the arrow, the stuff draws the under beam and tends to make it turn, whilst the catch of its ratchet wheel holds it, and the stuff G″ (see Figs. 1 and 3) stretches more and more; the same result would be produced by turning the under beam, after having raised its catch. When it is desired to pass any part of the stuff from one of the beams to the other, it suffices to raise at the same time the two catches and to turn in the proper direction the beam on which the stuff is wanted to be rolled, and to let the catch of the other beam drop; then it remains only to stretch the stuff.

Besides this system of under beams, there is a second system of two upper beams, for the same purpose, and which is disposed exactly in the same manner; it is also represented in Fig. 3, but it is not completely seen in Fig. 1, where it is hidden in part by some other pieces.

Supposing that one of these systems presents the stuff to the upper needles, and the other to the under: as the two beams of each system have not their axes in the same vertical plane, the plane of the stuff G″ (Fig. 3) would be inclined and would come to present itself obliquely to the needles, if the workman did not take care to put it straight, and bring it back exactly in the middle, by means of a strong wooden ruler, fixed, as well as the rollers, on

the two vertical sides of the frame; this ruler is shown at G′, Fig. 3, for each of the systems of beams.

The stuff must also receive a lateral tension, in the two opposite directions, and to effect this without its being torn, the operator sews on its edges, little ribbands of linen cloth or other suitable material, and afterwards ties to these ribbands, strings g'' (Fig. 1) which draw them laterally and which are fixed to the sides F of the frame.

It remains to see now, by what ingenious means, the frame may be displaced in all directions, without deviating from the vertical plane in which it had at first been fixed, and how the stuff which is fastened on it, and consequently forced to follow all its movements, may present opposite each needle, the successive points which must be pricked and crossed by the thread.

Mr. Heilmann, to obtain this result, uses the pantograph, by means of which he is enabled to reduce or extend, in fixed proportions, drawings of all kinds. Every one knows the principles on which this instrument is founded, and we shall only recall them to memory in a few words: $b\,b'\,f\,b''$ (Fig. 1) represents a parallelogram whose four angles b, b', f, b'', are hinged, and so disposed as to become either very acute or very obtuse, the sides keeping always the same length; the sides $b\,b'$, and $b\,b''$, are lengthened, one to the point d, and the other to the point c, and these points c, and d, are chosen, on condition that in one of the positions of the parallelogram, the line $c\,d$ which joins them, will pass through the point f; this condition can be fulfilled in many ways, since the position of the parallelogram remaining the same, it is evident, that in order to carry the point d further from the point b', it would suffice to bring properly the point c to the point b'', or *vice versa*; but when the distance $b'\,d$ has been once chosen, the distance $b''\,c$, is a necessary consequence. Now, the principle on which the construction of the pantograph rests is this: it is sufficient that the three points d, f and c, be in a straight line in only one of the positions of the parallelogram, to have them to remain always in a straight line, whatever its position be.

For, since in the present position, the line $c\,d$ passes through the point f, the triangles $b'\,d\,f$ and $b''\,c\,f$ are similar, as having equal angles; for $b'\,f$ being parallel to $b''\,c$, and $b'\,d$ to $b''\,f$, the three angles of the first of these triangles are equal respectively to the three angles of the second; we have then the proportion

$$\frac{b''c}{b''f} = \frac{b'f}{b'd}$$

but, in all the positions that the parallelogram may take, in opening or shutting arbitrarily the angle b, the sides will remain parallel, since the figure will still be a parallelogram; the angle $c\,b''f$ will then remain equal to the angle $d\,b'f$, and consequently, if in any other position, the point c be joined to the point f and the point d to the same f, the two triangles $b''\,c\,f$ and $b'\,f\,d$ which will result from it, will still have an equal angle comprised within two proportional sides; thus they will be similar, and the two lines $c\,f$ and $f\,d$ will be on the same line, that is to say, the three points c, f and d will remain in a straight line.

This once admitted, suppose that we move the point c, in a certain direction, in making all the system turn round the point d; let us imagine, for instance, that the point c comes in c': then, in joining d to c', it is evident that the point f will be found somewhere on that line $d\,c'$, in f', for instance, since it falls always on the straight line, which joins the point d to any position which the point c may take.

We have seen, besides, that the new triangles formed on $d\,c'$, (and analogous to the triangles $b''\,c\,f$ and $b'\,f\,d$ of the primitive position) are similar, and since the lengths $c\,b''$ and $b''\,f$, $d\,b'$, and $b'\,f$, are constant, we have:

$$\frac{c'f'}{d\,f'}=\frac{b''\,c}{b'\,f}:$$

in the primitive position we had

$$\frac{c\,f}{d\,f'}=\frac{b''\,c}{b'\,f};$$

it follows then

$$\frac{c\,f}{d\,f}=\frac{c'f'}{d\,f'};$$

the result is, that the line $f\,f'$ is parallel to $c\,c'$.

The same thing will happen, when the point c passes into another point c'': the point f will pass at the same time, into another point f'', and the lines $f\,f''$, $f'\,f''$, will be respectively parallel to the lines $c\,c''$, $c'\,c''$; then, lastly, the figures described by the point f in the diverse positions of the parallelogram, are always exactly similar to the figures described by the point c.

To find, now, the relation which exists between the outlines of these figures, it is sufficient to observe, that in the primitive triangles $b''\,c\,f$ and $b'\,f\,d$, we have:

$$\frac{c\,f}{d\,f}=\frac{b''\,c}{b\,f};$$

hence

$$\frac{c\,f+d\,f}{d\,f}=\frac{b''\,c+b'\,f}{b'\,f}$$

but

$$c\,f+d\,f=d\,c, \text{ and } b''\,c+b'\,f=b\,c;$$

thus

$$\frac{d\,c}{d\,f}=\frac{b\,c}{b'\,f}:$$

the triangles $d\,f\,f'$ and $d\,c\,c'$ being similar, we have also

$$\frac{c\,c'}{f\,f'}=\frac{d\,c}{d\,f};$$

hence it results

$$\frac{c\,c'}{f\,f'}=\frac{b\,c}{b'\,f} \text{ or } \frac{b\,c}{b\,b''}.$$

If the side $b\,b''$ has been made equal to the sixth part of $b\,c$, $f\,f'$ will be also $\frac{1}{6}$ of cc', that is to say, that in general the outlines described by the point f will be exactly the sixth part of the outlines described by the point c.

This proposition is that adopted by Mr. Heilmann.

It may also be observed, that the triangles $d\,b\,c$ and $d\,b'\,f$ being also similar triangles, we have

$$\frac{b\,c}{b'f}=\frac{d\,b}{d\,b'},$$

and as Mr. Heilmann has taken $b'\,d=b'f$, it results

$$b\,c=b\,d.$$

After this demonstration, which requires only the first notions of geometry, to be understood, it will be very easy to perceive how the pantograph acts in the embroidering machine. In looking over Figs. 1, 2 and 3, it will be seen in Fig. 1, that the side $b\,c$ has a handle B″, by which the workman puts the instrument in action; Fig. 2 shows the profile of the angles and hinges; and Fig. 3 shows more plainly, the support on which it turns, and the turning point by which it carries the stuff and frame in its movements.

To obtain more precision and solidity, the sides of the pantograph are joined together, so that the middle of their thickness is exactly in the vertical plane of the stuff, and the axles of the hinges as perpendicular as possible, to that plane in which, consequently, all

the movements are accomplished. This is effected by fixing on the large upper bar D″ a bent piece *d*″ (Figs. 1 and 3) having a proper jutting, and on which is also fixed the piece *d*′, which is joined to the extremity *b d* by a hinge; this piece *d*′ is fastened to *d*″ by an iron pin; but it has an oblong hole, and before fastening the nut it must be drawn backwards or forwards, until the support be exactly in the plane of the stuff. This condition being accomplished, it remains only to fix the frame to the angle *f* of the parallelogram; which is done by means of the piece F″ (Figs. 1 and 3.)

It is now plain, that, if the workman takes hold with his hand of the handle B″ (Fig. 1) and makes the pantograph move in any way, the point *f* will describe a figure similar to the figure described by the point *c* and 6 times smaller, as we have demonstrated, but the point *f* cannot move without moving the frame and all its supports; besides, if the frame is well fixed on all sides, and forced to move in the same plane, each of its points and of those fastened to it, will go exactly through the same way as the point *f*. Thus, in the motion of the pantograph, every point of the stuff describes a figure equal to that, described by the point *f*, and consequently similar to that, which the point *c* describes and 6 times smaller. It is sufficient, then, to give to the workman, who holds the handle B″ a drawing six times larger than that which must be executed by the machine, and to give him at the same time a sure and easy means to go with the point *c* through all the outlines of that drawing: for this purpose, there is fixed at *c*, and perpendicular to the parallelogram, a little style, terminated by a point C″, and the drawing is set on a vertical board E, parallel to the plane of the stuff and the parallelogram, and put back only a distance equal to the length of the style *c* C″ (Figs. 1 and 2;) this board is supported by the iron rod *e*′, fixed on an iron foot E′ (Fig. 1) which is also used for different purposes, as we shall show hereafter; the frame, loaded with its beams and stuff, forms a pretty heavy weight, and it will be observed that if it is necessary, as we have said to direct it, to keep it in its plane, it is necessary also to lighten it, so that the embroiderer may carry the point of the pantograph without effort or uncertainty in his movements.

Mr. Heilmann has accomplished this in the following manner:

1st. A rope *e* (Fig. 1,) tied to the side *b c* of the pantograph, passes over a pulley and supports at its extremity a weight which the workman may graduate, at will: this weight balances the pantograph and tends to raise the frame a little;

2d. The upper side F′ of the frame carries two jutting rulers,

the profile of which is seen at E″ (Fig. 3,) both have a longitudinal and horizontal slit in which the rod e'' may easily slide (Figs. 1 and 3), which thus is used as a guide to maintain in its plane, all the upper part of the frame, for the rods e'' are fixed to the great bar D″; the length of the slit at each of the rulers E″ must be equal to the amplitude of the lateral movement, which the frame can take;

3d. The under side of the frame, has two horizontal rods H and H (Fig. 1) supported by two small arms, which are a little bent, as shown at h (Fig. 2;) each of these rods is fixed in the groove of a pulley H′ (Fig. 1,) the blocks of which are of an oval form (Fig. 4) and supported by two triangular flanges h', h' on the two arms h'' which form the extremity of a forked lever H″, the profile of which is shown in Fig. 2; the two levers H″ must move together, in order that the two sides of the frame may be equally raised; therefore they are keyed on a shaft I′, supported at its two extremities by feet of cast iron I″ (Fig. 2,) a counterpoise I, which slides on the arms of the levers H″, and which, as it may be carried from or near the line of the supports, allows to raise the frame upwards to any required height, and without preventing the frame to move in all directions, prevents, however, its being displaced from the original plane, for which the pantograph had been regulated; the length of the rods H must also be equal to the amplitude of the lateral movement of the frame, and the arms of the levers H″ must be sufficiently long to let the arc, which they make the flanges h' (Fig. 4) of the pulley describe, be confounded by degrees with a straight line, in the greatest excursion from top to bottom or from bottom to top, which the frame can make.

4th. Two guides i, i (Fig. 1) supported on iron feet, have vertical slits in which the under side of the frame F is fastened.

ARRANGEMENT OF THE CARRIAGES.

Before we describe the arrangement and action of the pincers which carry the needles, we shall explain the disposition and movement of the two carriages which carry these pincers and all their mechanism.

These carriages, which are entirely similar, are disposed one at the right and the other at the left of the frame (Fig. 2;) we shall designate by the same letters of reference the pieces which compose them.

Each carriage executes its movements on a railway, composed of

two rails as straight as possible and horizontally fixed, one at each side of the machine.* One of these rails is seen at K (Fig. 2;) an end view is given on the right at No. 2, and its plan is represented in Fig. 5; the two jutting parts *k*, *k* are placed and bolted on two brackets, also bolted to the two vertical posts A C and A B of the frame: one of these brackets is seen at the left (Fig. 1,) the corresponding bracket of the other rail is seen also on the right, against the post A′ B′. The carriage itself is composed only of a long hollow cylinder of cast iron L (Figs. 1, 2 and 6) having at each of its extremities two wheels L′ which roll on the rails K (Figs 1 and 2;) the wheels L′ are mounted on a piece *l*′ (Fig. 2) forked to receive the axis of the wheels, and the piece *l*′ is also bolted on the piece or appendix *l* (Figs. 1 and 6) which is cast on the cylinder L.

These pieces, which, properly speaking, constitute the carriage, are then in perfect equilibrium on the rails K, and thus may with the greatest facility approach or withdraw from the stuff to prick or draw the needles.

But, to supersede the necessity of employing a person to produce these alternate motions of the carriage, Mr. Heilmann attaches to it, a piece of mechanism by means of which the workman who directs the pantograph, can himself without changing his place, conduct the carriages and regulate, as he pleases, the extent of their course as well as the rapidity of their motions.

This mechanism, will perhaps appear to many readers, at first sight, a little complicated, but in reality it is *simple* and *very ingenious*, and what is an essential point, it acts with remarkable precision. We shall now endeavour to make this part of the arrangement understood.

A pulley J (Fig. 2) is fastened against the post A B at the right of the frame, by two stands J′ and J″: a similar pulley is fastened to the other end of the frame against the corresponding post A′ B′ (Fig. 1:) in this figure, the last only has been represented, and that which is fastened to the post A B has been suppressed, to show the wheel *m* (see left side of Fig. 1, and edge view in centre of Fig. 2) on which it would project. On a level with the centre of the pulleys J is fixed an iron shaft M″ (Fig 1) supported in proper couplings or bearings, which are fixed against the large posts A C and A′ C′

* The reader will, of course, understand, that there are two sets of rails K K, with their pulleys L′ L′, one set on each side of the machine, as seen at K K and L′ L′ (Fig. 1.)

(Fig. 1.) of the frame; the shaft M″ has towards its extremities, but inside the frame, two cog wheels *m*: the left hand one is visible in Fig. 1, the right being hid by the pulley J; its left extremity (pantograph side) projects outside the frame, to support another cog wheel M (Figs. 1 and 2.) On the pulley J and on the corresponding cog wheel *m*, passes an endless chain *j* (Fig. 2:) the part of this chain which must pass round the circumference of the wheel *m* is called Vaucanson's chain (*chaine-de-Vaucanson*,) the other which must pass round the circumference of the pulley J is a simple strap; the two extremities of the chain *j*, are secured, one at *j′* and the other at *j″* (Fig. 2) to the piece *m″*, which is supported by the extremity of the stud-pin *m′* (see right side of Fig. 1) which is fixed in the piece *l* of the extremity of the cylinder L; this same stud-pin also carries a roller which runs under the rail K, to steady the carriage.

It results from this arrangement, that by turning the shaft M″ (Fig. 1) or the wheel M (Fig. 2) in the direction indicated by the arrow (Fig. 2,) the carriage will be forced towards the stuff; and, on the contrary, by turning the wheel M in a direction opposite to the arrow, the carriage will move from the stuff.

The left hand carriage (Fig. 2) is arranged exactly as the right hand one, which we have just described; every thing is the same and designated by the same letters of reference, with the exception of the wheel M, which is at the extremity of the shaft M″ corresponding to the second carriage, it is designated by the letter M′, because it is necessary to distinguish the two wheels M and M′, which are, however, in all respects similar and fixed in the same manner.

When one of the carriages has advanced and pricked the needles into the stuff, the other is there ready to receive them, it takes hold of them, draws them, performs its course in removing, to draw the thread and tighten the stitch, afterwards; it comes back and brings the needles to prick the stuff in its turn; during its motion, the first carriage must remain in its place waiting for it; thus the two carriages go alternately backwards and forwards, but never move at the same time.

To effect this, Mr. Heilmann has disposed on the piece O, which is bolted on the two posts A C and A D of the frame, a bent lever *n o n′ n″*, moveable round the point *o*; the bending n′ has a cog-wheel O′, and the extremity *n″* another cog-wheel O″; the four wheels M, M′, O′ and O″ have similar teeth and diameter; the two wheels O′ and O″ are fixed in relation to each other, so that it is sufficient to turn the handle N (Figs. 1 and 2) to make the wheel

O″ turn, and consequently the wheel O′: when the lever *n o* is vertical, the wheel O′ touches neither the wheel M nor the wheel M′, but when inclined to one side or the other, it will mesh or gear alternately into the wheel M or the wheel M′.

Viewing these parts as they are represented by Fig. 2, it is evident, that by turning the handle N in the direction indicated by the arrow, the wheel M will turn in the direction indicated by its arrow, and the right carriage will approach to the limit which prevents the pincers from touching the stuff, with a rapidity which depends entirely on the person who turns the handle N: by turning the handle in a contrary direction, the carriage will go backwards, and the simple movement of the lever *n o* (Figs. 1 and 2) will suffice to act alternately on the left or on the right hand carriage. The reader will perceive, that when the lever *n o* is vertical, the wheel O′ will neither touch the wheel M nor yet the wheel M′, but if the lever *n o* is inclined to one side or the other, the wheel O′ will be geared into the wheel M or M, alternately.

The workman having one of his hands occupied with the handle B″ of the pantograph, and the other with the handle N, he has only his feet left to act on the lever *n o*, and as he has yet many other things to do, Mr. Heilmann has placed before him two treadles, by means of which he executes with his feet a series of operations not less delicate than those he executes with his hands.

For the present, we shall consider these treadles only as the means of communicating motion to the lever *n o*.

The treadles P (Figs. 1 and 2) are moveable round the axis *p* (Fig. 1), and have ropes *p′* rolled in a contrary direction on the pulleys P′; these pulleys are fixed on a shaft P″ (Figs. 1 and 2) supported on one side by the stand E′, and on the other by a piece K′ fastened to the two large posts of the frame A C and A D (Fig. 2); the shaft P″ supports at its extremity a piece *r*, represented in front, and a side view No. 3, a little above, and at the left of the place which it occupies (Fig. 1); it has teeth on a portion of its circumference (we shall see further the use of these teeth, but for the present we have only to speak of the part without teeth); and is furnished with a pin, which goes into the forked extremity of the lever *n o;* now, it is evident, that by lowering the treadle P, which is now raised (Fig. 1) the upper part of the shaft P″ (supposed to be seen from the end as in Fig. 2) will turn from left to right, and the lever *n o* will be inclined so as to gear the wheel O′ into the wheel M′, but at the same time, the treadle which is now down will be raised, because its rope P′ (Figs. 1 and 2) will of necessity be rolled

on its pulley in proportion as the other rope will unroll, so that the apparatus will be quite ready to act in a contrary direction, when needed.

ARRANGEMENT OF THE PINCERS.

The shaft L′ (Figs. 1 and 2) supports from distance to distance, at spaces of about half a metre, appendices *q q* fastened to it (see also Fig. 6, where the scale is larger); it is to these appendices that are fastened, with two bolts, the curved arms Q (Figs. 1 and 2) which are destined to support all the mechanism of the pincers; Fig. 6 represents a part only of one of these arms but as they are disposed nearly in the same manner above and below (see Fig. 2) the shaft L′, this part is sufficient, with the Figs. 1 and 2, to give a complete idea of them: an iron rail, forming a well set triangular prism, represented at S (Figs. 6 and 7), extends between the two consecutive arms Q, Q, as seen in Fig. 1, and it is fixed against each of these arms by means of an ear *s*′ (Figs. 6 and 7) in which passes an iron pin which crosses the thickness of the arm but instead of a simple hole, the ear has a slit which allows to carry it backwards or forwards. The workman can then put, one after another, in a very straight line, the three rulers S, which must be found in the three intervals of the arms Q (Fig. 1); each of them is a little prolonged beyond its two ears, so that, after they are properly arranged, the three consecutive rulers, seem to form but a single triangular prism, extending from one end to the other of the carriage. This prism is destined to receive and to support all the pincers that are found in a row.

Figs. 8, 9, 10 and 11, represent the different parts which compose one of the pincers. At T (Fig. 8) is seen the under jaw, set in its place and fixed on the prismatic ruler; it will be observed easily that it has:

1st. Underneath, a little to the left, a set screw *t*, by means of which it is fixed on this prismatic ruler, the form of which ruler it has at its under part;

2d. At the left extremity (see Figs. 6 and 8), a spring *t*′, used to raise the end of the upper jaw V, in forcing it to shut and to press against the under jaw;

3d. Upwards, and towards its middle, two little round ears, with a hole in them, and separated from each other by an interval equal to the thickness of the upper jaw, and destined to receive the corresponding ear *v* of this jaw;

4th. A little to the right of the ears, a small vertical jutting t'', serving to stop the needle, if by any cause it should be misplaced or too much in advance;

5th. At the right extremity, a thin plate T′, having a conical hole larger inside than outside; a front view of this plate is represented at Fig. 11.

The upper jaw V has been removed from its place in Fig. 8, in order to show its form better.

It will now be perceived, that if the upper jaw V of the pincer (see Fig. 8) is dropped down into its place between the ears t'' and a pin passed through these ears, the pincer will be complete, or like that shown in Figs. 2, 6 and 7.

In order that the pincer may be opened to receive the needle, the long end of the upper jaw V must be pressed down sufficiently to overcome the elasticity of the spring t'.

Fig. 9 represents a view of the pincer from above (a plan view); it also shows the size of the jaws and that of the spring t'.

Fig. 10 represents a pincer, seen from the end, on the side of the plate T′.

Fig. 12 represents a needle V′, of full working size; the eye is in the middle, the thread is put in it as in a common needle, but it is not doubled, the filaments of the short end are only mixed with those of the long near the needle, and are slightly twisted, so that they may hold better, and go more easily through the stuff through the hole which the needle makes.

When a pincer is opened and half of the needle comes to be engaged in it, by the opening of the plate T′, it is fixed in an angular groove, the depth of which is a little less than the diameter of the needle; and when the pincer is shut, the upper jaw V, holds it in the groove; thus the needle is held fast, by three points of its circumference.

Suppose now, that all the pincers are set at a proper distance on the prismatic ruler S (Figs 6, 7 and 8) to form the upper row of the right hand carriage, as seen in Fig. 1, we shall endeavour to explain by what kind of mechanism the workman succeeds in opening, at the same time, all the pincers of the upper row, when they should deliver up the needles to those of the opposite carriage, after having pricked them into the stuff.

There is for this purpose, an iron shaft U which extends from one side of the carriage to the other (see Fig. 1); an end view of this shaft is shown at U Fig. 13, by which it will be seen, that it is flat on one side: this shaft is supported by little forks u (Fig. 6) which

are fastened with bolts at the extremity of the arms Q, and it is fixed there by a key-pin u'; the shaft is round in the parts which rest in the forks, and these are of such a height, that when its flat part is turned downwards, it touches the ends of all the upper jaws V, without pressing them, so that the pincers remain shut, and it opens them when it turns on its axis, by forcing down the springs t'.

To produce this effect, Mr. Heilmann fixes at the two extremities of the shaft U two sectors with teeth x, x, a side view of which may be seen in Fig. 2; each of these sectors gears into a toothed vertical ruler X (Figs. 1 and 2) which can slide against the arm Q of the carriage, where it is fixed, and the ruler X has at its under part an horizontal pin x' (Figs. 1 and 2); it is by means of these pins that the movement is communicated to the ruler X, and to the sector x, and consequently to the shaft U, to open and shut the pincers.

We shall now try to explain how the workman performs this operation, by means of the two treadles P (Figs. 1 and 2.)

We have already said, that the shaft P'', which is put in motion by the treadles P, supports at its right extremity (Fig. 1) a piece p' destined to make the lever $n\,o$ act; this piece is represented in front at Fig. 2, and on the left at No. 3; it has teeth on two-thirds of its circumference, and is used as a pinion; with its toothed part, it gears into a sector r, fixed at the extremity of the shaft R (Figs. 1 and No. 3) which can revolve on its axis and is supported by proper bearings $r'\,r'$ (Fig. 1), placed in the middle of the horizontal and lower bars of the frame. The shaft R also supports two arms Z Z (Fig. 1 and No. 3), placed crosswise upon it, and terminated by forks z and z'; the two forks designated by z' correspond to the left hand carriage (as seen in Fig. 2), and those designated by z correspond to the right carriage; they are destined to receive the stud-pins x' of the notched rulers X; and it is very easy to understand how they operate. For, taking these parts as they are represented in Fig. 2, let us suppose that the workman brings the right carriage towards him, by turning the handle N, in the direction of the arrow: then, the carriage advancing, secures the stud-pins x' in the forks z', and pricks into the stuff the jutting half of the needles which it carries, and these halves enter into the pincers of the left hand carriage, which are open to receive them, it is then necessary instantly, to shut the left hand carriage pincers, so that they may take the needles and open the right hand carriage pincers to give them up. This the workman does with his foot, at once; he bears on the raised treadle to draw the rope which it sup-

ports; then the movement of rotation which is produced in the corresponding pulley is communicated to the shaft P'', pinion p'' sector r, shaft R, and simultaneously to the two arms Z, Z, the extremities z, z of these arms (Figs. 1 and 2) are raised and carry the stud-pins x' in their ascending movement, consequently the toothed rulers X ascend in sliding in their grooves or guides, make the sectors x and the flat sided shaft U turn, which gives pressure on the end of all the upper jaws V of the pincers and opens them all at once, by means of the arms Z Z (No. 3), the forks z,' z' which terminate them at the left, descend and carry with them the stud-pins x' of the toothed rulers X of the left hand carriage, make the corresponding sectors x turn as well as the flattened shaft U, on which they are fixed; its flat side coming on the ends of the upper jaw V of the pincers, and all the pincers of this side are shut by means of the springs t'. Thus at the same time, the workman shuts the pincers of the left hand carriage and opens those of the right hand carriage, which will remain open until they have received the needles, after the return of the left hand carriage. The same movement of the treadle, which produced this double result, has also changed the position of the lever n o (Fig. 2) and brought the wheel O' on the wheel M'; so that the workman has only to turn the handle N to give motion to the left hand carriage, which draws the needle and tightens the stitch.

The threads are stretched in proportion as the carriage withdraws, but this tension presenting no elasticity, some inconvenience might have happened, had not Mr. Heilmann fixed to the carriages a piece of mechanism by means of which every thread is pressed at the same time by a weight, which is easily regulated, as will be hereafter more fully explained.

The reader will see in Fig. 1 (a little below the prismatic rail which supports the pincers) a shaft Y which extends across the carriage and projects over it at each side; this shaft is supported by pieces y which are bolted on the arms Q (Figs. 1, 2 and 6) in which it may turn; at its left extremity, it has two little bars y' and w, and at its right extremity a single bar y' and a counterpoise y'' which may be seen in Fig. 2; the extremities of the two bars y' are connected by a stout wire which extends across the machine (Fig. 1) and which wire must be very straight: this wire is simply twisted together at its ends after having taken a turn round the notched ends of the bars y', as will be seen, on close examination (Fig. 1); the position of the wire, connected to the ends of the bars y' is also indicated in Figs. 2, 6 and 7; all the threads which come from the needles must

pass under this wire, (see Figs. 2 and 6.) When the carriage approaches the stuff, and before the wire touches it, the bar *w*, (the position of which is seen in Fig. 2) meets a stud-pin *w'* (Fig. 1), which bears against it and raises it gradually; the bars *y'*, *y'* and the wire which connects them is raised at the same time and take the position represented in Fig. 7: on the contrary, when the carriage, in leaving that position, goes from the stuff, the bar *w* slides in descending on the pin *w'*, is removed to a little distance, and then the counterpoise *y''* makes the bars *y'* fall, bringing down the wire which connects them, on all the threads of the needles; after which the machinery takes the position indicated in Figs. 2 and 6.

In the description just given, we have only considered the upper range of pincers and needles, in order to simplify our demonstrations, but it will be seen that in Figs. 1 and 2, there is an under range of pincers and needles which are also connected to the lower extremity of the arms Q, exactly similar to the upper range; the machinery which opens and shuts the pincers is also the same, and operates simultaneously, which will be seen by referring to Fig. 2, because the sectors *x x* and toothed rulers X X are the same: the flattened shaft U of the upper carriage is precisely the same as that of the under carriage. Tension is communicated to the threads of the lower needles by an arrangement the same as that above designated by the letters of reference Y, *y*, *y'*, *w* and *w'*, (see Figs. 1 and 2.)

Having thus described, to the best of our ability, this beautiful piece of mechanism, we will offer a few remarks in regard to its operation.

The size of the patterns which the machine can embroider is limited, as well as the number of needles to be set at work; because, all the needles in each carriage (on the same horizontal line) have each its respective pattern, so that the number of patterns to be embroidered will be equal to the number of needles employed. For example, in Fig. 1, there are 15 patterns in each range; these would require one needle each; it is therefore evident, that the distance between the needles, respectively, must be somewhat greater than the breadth of the pattern to be embroidered, or the motion of the frame would cause a part of the stuff which had been embroidered by one needle, to come in front of another needle.

Therefore, if it is desired to work with 130 needles, 65 above and 65 below, and if, for example, each pattern was to be 7 inches in breadth, it is very evident, that the distance between the needles should be rather more than 7 inches, and would require a machine

more than 65 times 7 inches, or about 13 metres in breadth: but, the arrangement of the mechanism will not allow to give the machine so great a breadth: hitherto the machines have been confined to $2\frac{1}{4}$ metres for the working part, carrying on this space 130 needles, that is to say, 65 above and 65 below, set at a distance of about $1\frac{1}{3}$ inches apart (mettre á la distance d'environ 4 centimètres); this then is the maximum of the breadth of the patterns to be embroidered.

To embroider patterns of a larger size the number of needles must be diminished so as to allow of a greater distance between them: it would be necessary, for instance, to reduce them one-half, to produce patterns 3 inches (8 centimétres) wide.

But, in diminishing the number of needles, we decrease the advantages of the machine; because, it requires as much time to work a carriage with 50 needles as one with 130.

Although the machine is limited in its width, it has the advantage of having no limit in its length or height; it may, for instance, embroider at the same time 130 ribbands of any length; it will suffice to dispose these ribbands on the beams G, and to embroider all the height which the vertical motion of the frame allows; then the workman marks the place where he has left off, and stops the working of the machine for a moment, while he rolls on one of the beams G the embroidered part which he had executed, and brings before the needles the new stuff which is to be embroidered; he makes the point of the pantograph rise or descend, according to the part last finished, whether above or below, the pattern on the table E (Fig. 1) being raised or lowered to correspond; and then continues to embroider from the mark which he had made before rolling the stuff on the beam.

It will be perceived, that the workman must not follow with the pantograph, the pattern which is on the board E, but must stop the point of that instrument on the point or little square of the design paper or pattern which the needle is going to prick, he carries it again and stops it on the point through which the needle should go or enter in returning, and so forth.

To facilitate this kind of reading, the pattern which is on the board E, is composed of straight lines, crossing each other at right angles, as in Fig. 70, (which see) so that the workman has continually under his eye the pattern divided off into small squares, which he must follow with the point of the pantograph; should he happen to be interrupted and have neglected to mark the place where he left off, he must look at the embroidered stuff in the machine,

to see what has been already embroidered and to find by comparison with the pattern on the table E, where he is to commence his work again, in order to leave nothing undone and not to repeat twice the same thing.

INDEX TO PLATES 1 AND 2.

A B C D, Fig. 2, The side of the frame where the workman sits.

A′ B′ C′, Fig. 1, The opposite side of the frame.

A″, Fig. 1, Lower cross-bars which connect the feet of the two sides of the frame.

a, The six feet of the frame, (Fig. 2) on the pantograph side.

a′, The six feet of the opposite side of the frame, (see Fig. 1).

a″, Fig. 1, Knees which unite the cross-bars A″ to the vertical posts of the frame.

B″, Figs. 1 and 2, Handle of the pantograph.

b, *b*′, *b*″, Three of the angles of the pantograph.

c, Point of the side *b b*″ on which the point is fixed.

C″, Fig. 2, Point of the pantograph.

D″, Figs, 1 and 2, Cross-bar in the shape of a trough which unites the frame above.

d, Fixed points on which the pantograph turns.

E, Fig. 1, Board on which the pattern to be embroidered is put.

E′, Support of the board E.

e, Rope attached by one end to the side *b c* of the pantograph, passing over a pulley, and having a weight at the other end.

e′, Iron rod to support the board E.

E″, Fig. 3, Sliding rule fixed on the side F of the frame.

e″, Figs. 1 and 2, Rod fixed on the cross-bar D″ and sliding in the sliding rule E″.

F F, Figs 1, 2 and 3, Vertical posts of the frame which carries the stuff.

F′ F′ Figs. 1, 2 and 3, Horizontal sides of the same frame.

F″, Figs. 1 and 3, Stand fixed on the upper side F′ of the frame and connected by an axis pin to the pantograph.

f, Fourth angle of the parallelogram which forms the pantograph.

G, Figs. 1, 2 and 3, Four rollers or wooden beams fixed on the vertical posts of the frame for carrying the stuff.

G′, Figs. 3 and 7, Two rulers fixed on the same posts and intended to maintain in the same vertical plane, the stuff rolled on the beams G.

g, Fig. 3, Ratchet wheels fixed at one of the ends of the rollers G.

g′, Catches which hold the wheels *g*.

G″ Stuff.

g″, Fig. 1, Strings used to stretch the stuff sideways.

H, Guide-rods fixed to the under side of the frame which carries the stuff.

h, Figs. 1 and 2, Curved arms which support the rods H.

H′, Figs. 1 and 3, Throated pulleys in which the rods H slide.

h′ *h*′, Figs. 1 and 4, Flanges by which the blocks of the pulleys H′ are supported.

H″, Large levers which support at one end the blocks of the pulleys H′ and at the other counterpoises I (Fig. 2.)

h'', Fig. 1, The two extremities of the forks of the levers H''.

I, Counterpoise of the lever H''.

I', Fig. 2, Shaft on which are supported the levers H'', fixed to answer for each other and so that the two sides of the frame which carries the stuff be supported and moved at the top with an equal force.

I'', Figs. 1 and 2, The two supports of the extremities of the shaft I'.

i, Fig. 1, Two iron feet having a vertical slit in which slides the under edge of the frame, serving to maintain it in its plane during its motions.

J, Fig. 2, Pulleys at each end of the frame.

J' and J', Figs 1 and 2, Stands which support the pulley J.

j, Endless chain.

j' and *j''*, Points to which the extremities of the endless chain are attached.

K, Figs. 1, 2 and 5, Rails for the carriages; Fig. 5 represents one of these rails, seen from above, with flanges *k* by which it is bolted to the upright posts B of the frame.

K', Fig. 2, Cross pieces bolted to the two posts A D and A C and supporting the extremity of the shaft P''.

k, Flange of the rails K.

L, Figs. 1, 2 and 6, Shaft or cylinder of the carriage, having at its two extremities a flange by which it is fastened to the wheel-carriers *l'* and having besides from distance to distance appendices *q*, *q* destined to receive the large arms Q Q.

l, Flanges, through which the axis of the shaft L is fixed to the wheel-carriers *l'*.

L', Small wheels which support the carriage on the rails K.

l', Wheel-carriers, forked at the two extremities to receive the axles of the small wheels L'.

M, M, Figs. 1 and 2, Cog-wheels, set on the front extremity of the axles M'' and outside of the frame.

m', Fig. 1, Cog-wheel, set on the shaft M'' inside the frame.

M'' M'' Two shafts turning in bearings fixed on the large posts A D, A D' and A C, A C' of the frame; one of these shafts is shown in Fig. 1.

m' Stud-pin crossing the piece *l'*, and supporting the wheel L' which rolls on the rail K.

m'' Fig. 2, Piece supported also by the stud-pin, *m'* and to which the endless chain is connected, (Fig. 2).

N, Figs. 1 and 2, Handle by means of which the wheel O'' Fig. 2, is turned, to move the carriages forward or backward.

n, *n'*, *n''*, Bent lever supporting the two cog-wheels O' and O'' and supported by the axis pin *o*, Fig. 2.

O, Cross-bar (Fig. 2) connecting the sides A C and A D of the frame.

o, Support or axis of the lever *n*, *n'*, *n''*.

O' and O'', Two cog-wheels gearing into each other, fixed to the points *n'* and *n''* of the bent lever *n*, *n'*, *n''* and moving with it (Fig. 2.)

P, Figs. 1 and 2, Two treadles.

p, Axis of the treadles P.

P' Pulleys fixed on the shaft P'' and moving with it.

p' Ropes which connect the treadles P to the pulleys P'.

P'' Shaft which carries the pulleys P'.

p'' Piece fixed at the extremity of the shaft P''; it has teeth on $\frac{2}{3}$ of its circumference, and the other part is prolonged and

has a stud-pin which goes through the forked extremity of the lever *n o* to make it move, Figs. 1 and 2.

Q, Q, Figs. 1, 2 and 6, Large arms of cast iron, which are fixed on the shaft or cylinder L by means of the flange *q*, *q*.

q, *q*, Flange intended to support the arms Q Q.

R, Fig. 1, Shaft supported at the under part of the frame by two bearings *r′ r′*.

r′ Sector with teeth, supported on the extremity of the shaft R, and gearing into the pinion *p″*.

r′ r′, Bearings fixed on the frame and supporting the shaft R.

S, Figs. 1, 2 and 6, Prismatic rule supporting the pincers; it is fastened between two consecutive arms Q Q by means of the ears *s′ s′*.

s′ s′ Ears to which the arms Q Q are bolted.

T, Figs. 6, 8, 9 and 10, Under jaw of the pincer.

t, Screw intended to fasten it on the prismatic rail.

T′, Plate pierced by a hole through which the needle goes into the pincer, (Fig. 11).

t′ Spring intended to press down the upper jaw of the pincer on the needle.

U, Fig. 1, Flat shaft supported by the extremity of the arms Q Q; it is also shown in Figs. 6, 7 and 13.

u, Fig. 6, A small fork piece which supports the axis of the shaft U.

u′, Key pins which keep the axis of the shaft U in its place in the fork pieces *u*.

V, Upper jaw.

v, Ear used to connect, by means of a pin, the upper jaw of the pincer with the under one, (Fig. 8).

V′, Fig. 12, Needle of the full size, with the eye in the middle.

w, Arm at the extremity of the shaft Y, and intended to make the shaft turn at the moment when it leaves it.

w′, Stud-pin fixed to the frame, and against which the small arm *w* slides, Fig. 1).

w″, Two small arms fixed, one on the upper shaft Y, the other on the under shaft Y′; they are connected by a wire, so that the motion of the shaft Y produces that of the shaft Y′, (see middle of Fig. 1.)

X, X, Figs. 1 and 2, Two vertical rules with teeth sliding against the arms Q Q.

x, Sectors gearing with the teeth of the rules X and fixed on the flat shaft U with which they turn, (Fig. 2.)

x′, Stud-pins fixed at the bottom of the rules X, Figs. 1 and 2.

Y, Y′, Figs. 1 and 2, Shafts supported by the arms Q and turning freely.

y,′ *y′*, Small perpendicular arms or rods on the ends of shaft Y, Figs. 1 and 2.

y″, Counterpoise of the arm or rod Y, Figs. 1 and 2.

Z Z, Arms fixed on the shaft R; each being terminated by two forks *z z*, Fig. 2, one at the right, and the other at the left.

z, *z′*, Forks which terminate the arms Z Z, and which are intended to receive the stud-pins *x′* of the toothed rules X X.

No. 1, Horizontal section of the post A B, seen from above, and also showing the thickness of and the shape of the foot *a*.

No. 2, Section of the rail K.

No. 3, A view in profile and in front of the pinion *p″*.

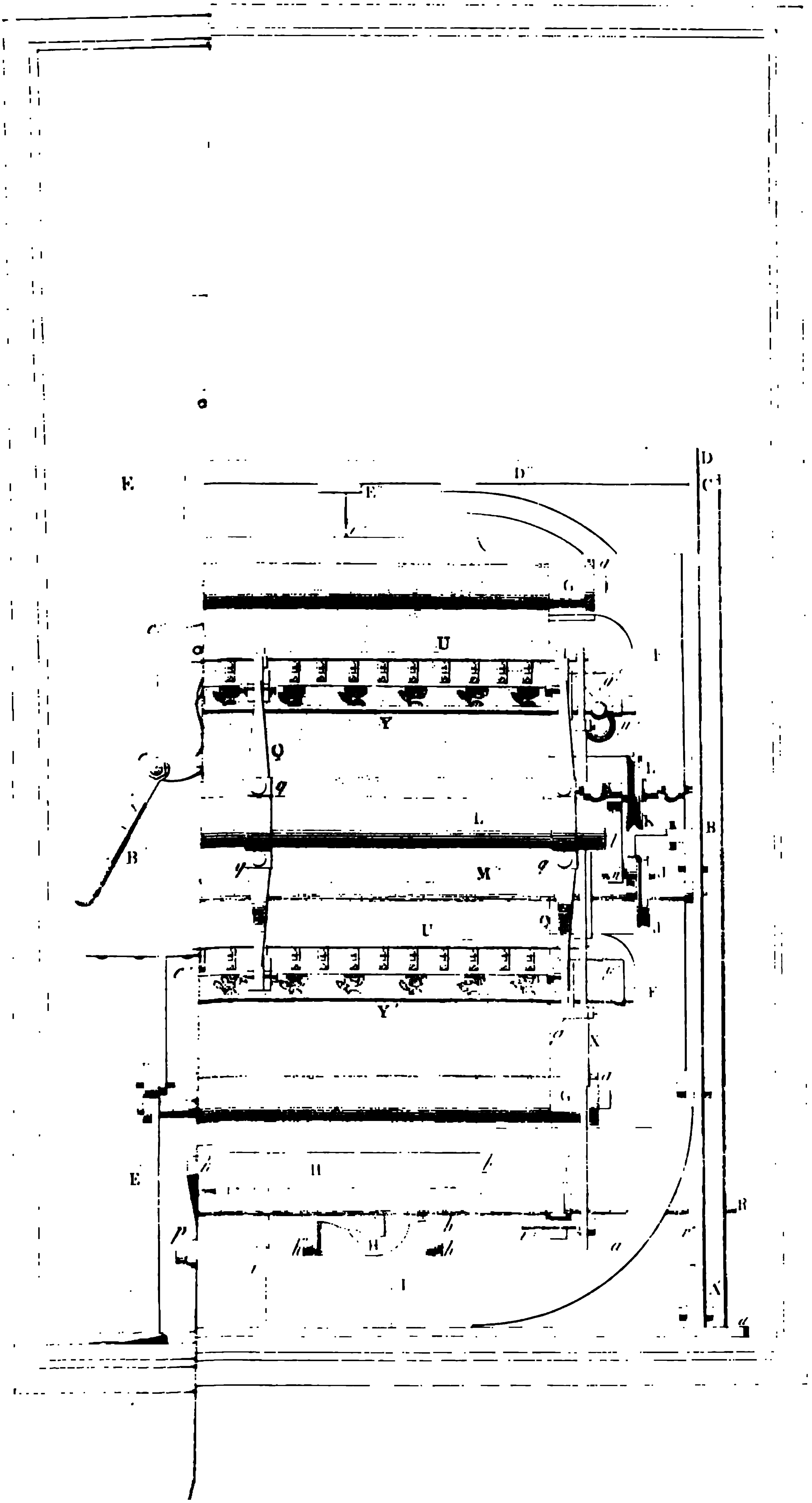


PLATE 11.

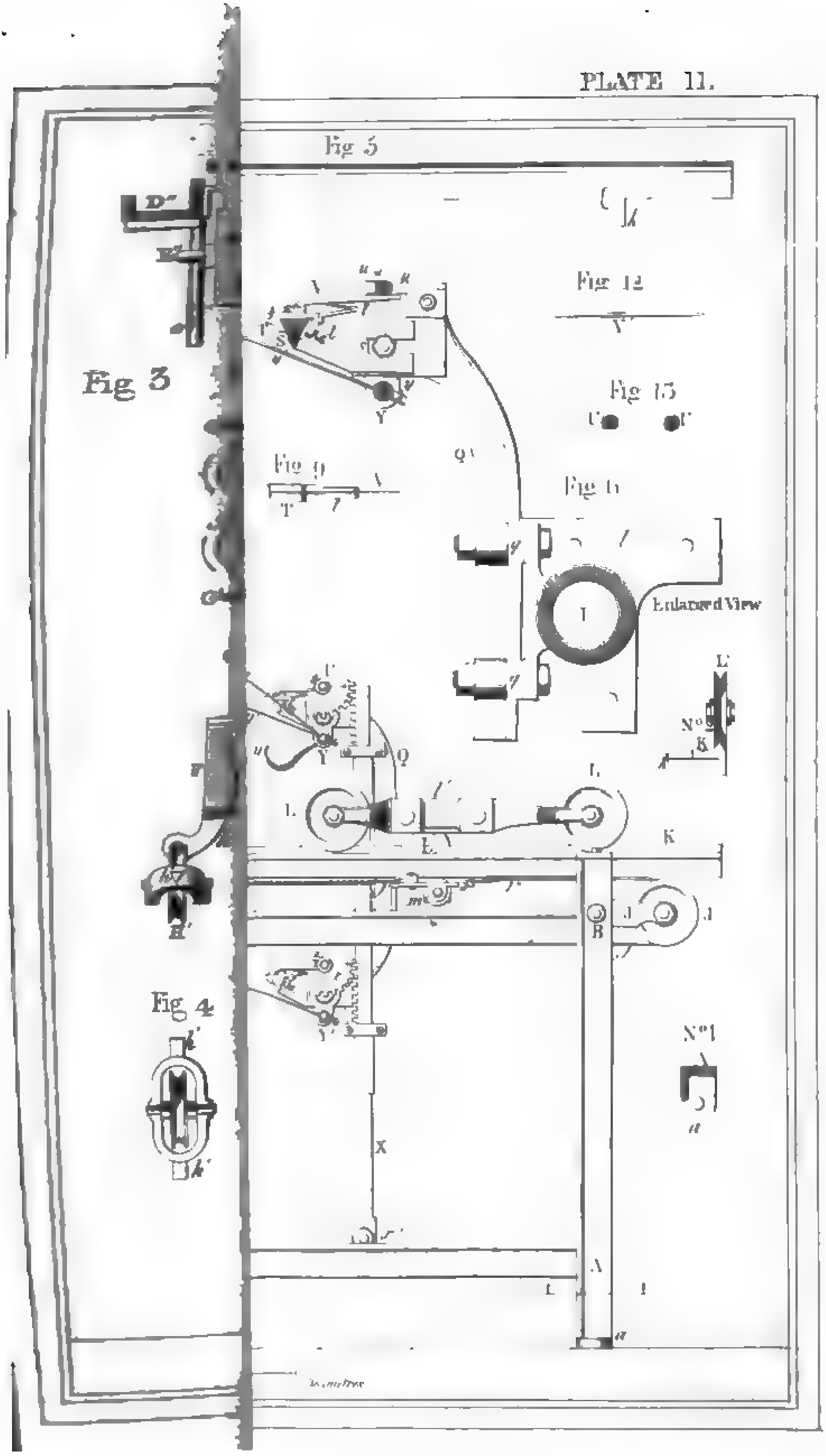
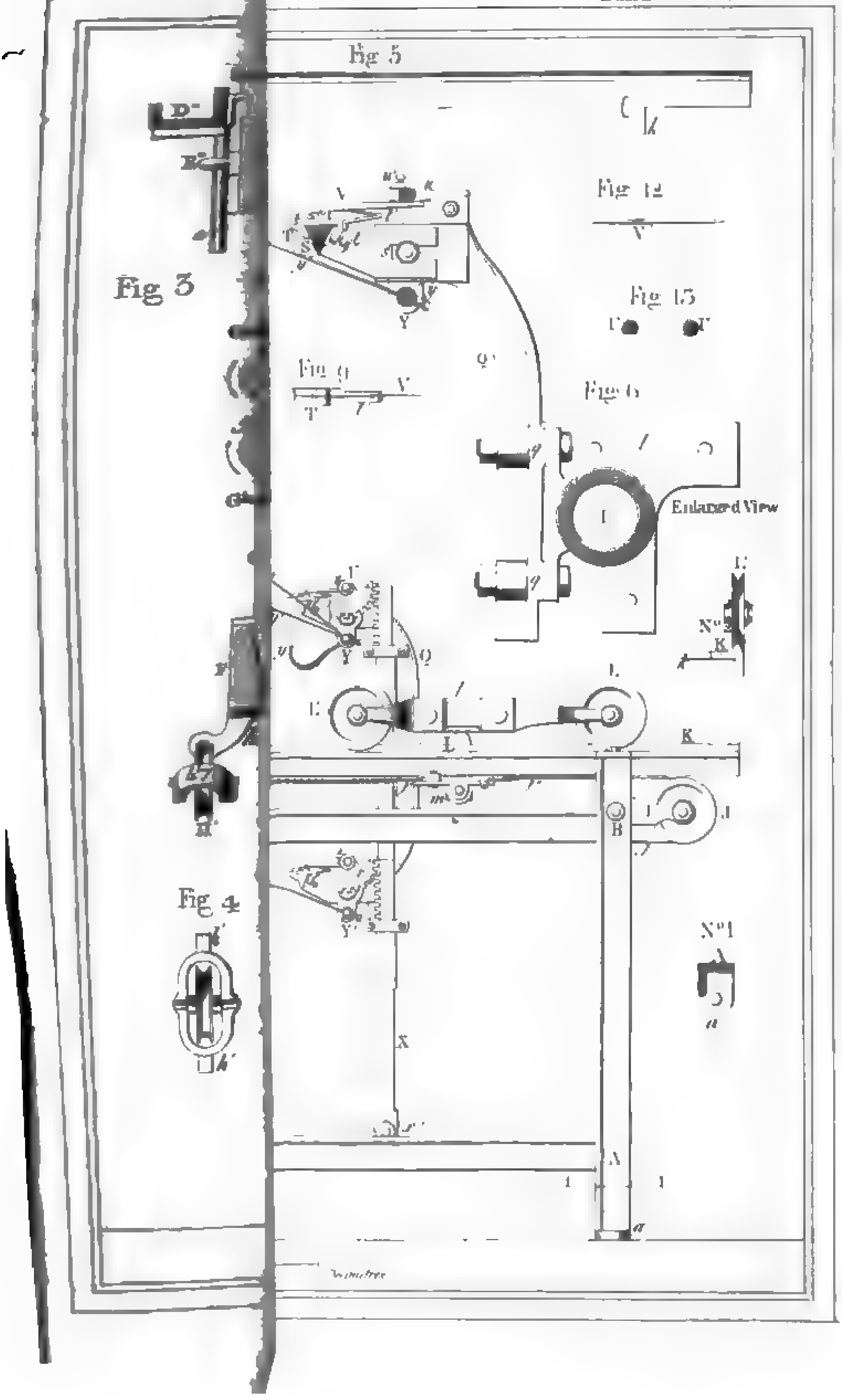


PLATE II.



In concluding this part of our subject we cannot but express our admiration of those talents which have overcome difficulties in the construction of machinery, as great as any ever conquered by human skill and perseverance. The embroidering machine is not the only invention which Mr. Heilmann has given to the world; for we find, by referring to the records of the "Société Industrielle de Mulhausen," accounts of several other inventions of his in different branches of manufactures, particularly in power loom weaving; and among many interesting papers furnished by this gentleman and published in the "Bulletin" of the "Société," there is a memoir entitled "Observations Microscopiques sur la forme, la finesse, et la force des filamens de Coton," containing much valuable information.* Indeed, we may say of Mr. Heilmann what Lord Jeffrey

* We extract the following * * *morceau* from page 543 of a book entitled, "Baines's History of the Cotton Manufacture."

"NOTE

Relative to the Form of the Fibres of Cotton. By JAMES THOMSON, F.R.S.

In the first volume of the '*Bulletin de la Société Industrielle de Mulhausen*,' published in 1828, is a memoir, by Mr. Josue Heilmann, entitled 'Observations Microscopiques sur la forme, la finesse, et la force des filamens de Coton,' in which he ascribes to the fibres of Cotton the same form precisely given to them in the drawing of Mr. Bauer, dated Feb. 11, 1822, which accompanies my paper 'On Mummy Cloth.'

Mr. Heilmann's 'Observations' are accompanied by a drawing of Mr. Edward Koechlin, of the fibres of cotton. Whoever will take the trouble to compare the two drawings, will detect internal evidence of the one being derived from the other. Mr. Heilmann's paper being published in 1828, and mine in 1834, renders some explanation necessary.

In 1822 or 1823, Mr. Edward Koechlin was in England, and during a visit he paid to me at Primrose, he saw Mr. Bauer's drawing, and requested permission to copy it, which was readily granted. It is from this drawing and Mr. Koechlin's communication, that Mr. Heilmann's 'Observations Microscopiques' are derived.

The paltry fraud of appropriating to himself the observations of others, without acknowledgment, might have passed unnoticed by me for ever, had not the friends of Mr. Bauer considered this explanation necessary."

We have the pleasure of being well acquainted with Mr. Heilmann, and know that he is not only an extremely ingenious man, but also a man of sterling honour and strict integrity, and altogether incapable of any thing of this sort.

said of James Watt:—"Independently of his great attainments in mechanics, he is an extraordinary, and, in many respects a wonderful man;—possessing infinite quickness of apprehension, a prodigious memory, and a certain rectifying and methodizing power of digesting and arranging in its proper place, that which is really valuable in practice, and of casting aside and rejecting, as it were instinctively, whatever is worthless or immaterial."

SECTION NINTH.

SPOOLING, WARPING AND SIZING, BY POWER.

THE processes of spooling, warping and sizing having been already thoroughly investigated, as applicable to looms worked by hand (see Section First,) it only remains to show how these various processes may be facilitated, by the application of power instead of manual labour: this subject we shall now endeavour to elucidate.

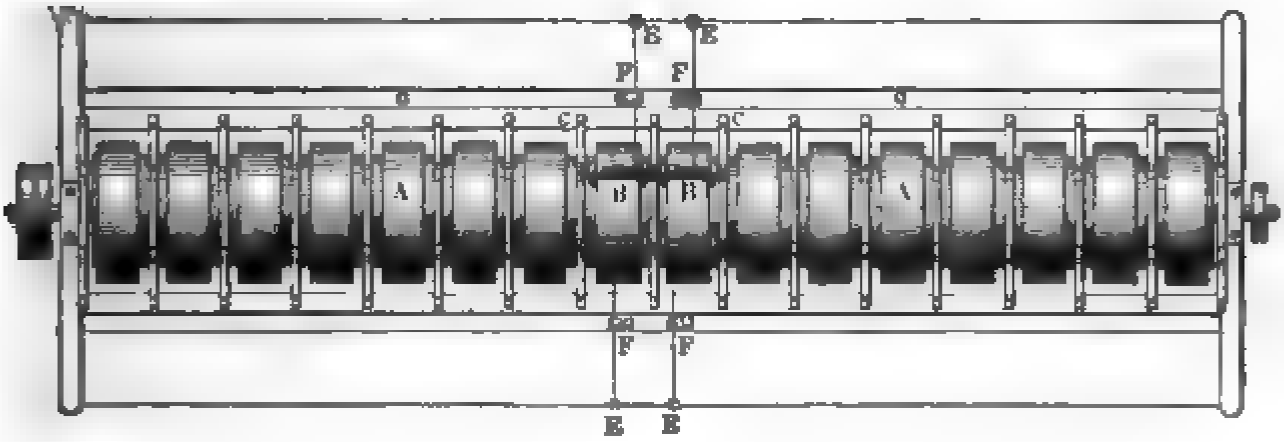
Were we ambitious of confusing the wits of the rabble with *very learned* dissertations on spooling, warping and sizing, we would call in the aid of that mysterious art, known to patent agents and quack doctors by the cognomen of "*saw-dusting*;"* but our object is to diffuse *light* and not *darkness.*

Fig. 148 represents a common cylindrical shaft, containing 16 drums A, with four spools B B B B, which roll against the drum, by friction of contact; C C represent cast iron arches fixed between each pair of drums, and serving to keep the spools in their places

* A villainous system of trickery or deception, by which a lie is garnished over and made to appear as truth: it is commonly practised by men of no real inventive talent or capacity; but whose impudence is their grand substitute for genius. Such characters often apply to some dishonest patent-agent, or petty lawyer, whose business it is to assist them in their difficulties; which he does by drawing out a long windy rigmarole specification of some 5,000 odd words, purposely to work up the invention or inventions of some ingenious man, under pretence of making improvements thereon; and then gilding the pill over so skilfully in the summing up of the claim, as to be swallowed by the public without a shrug!

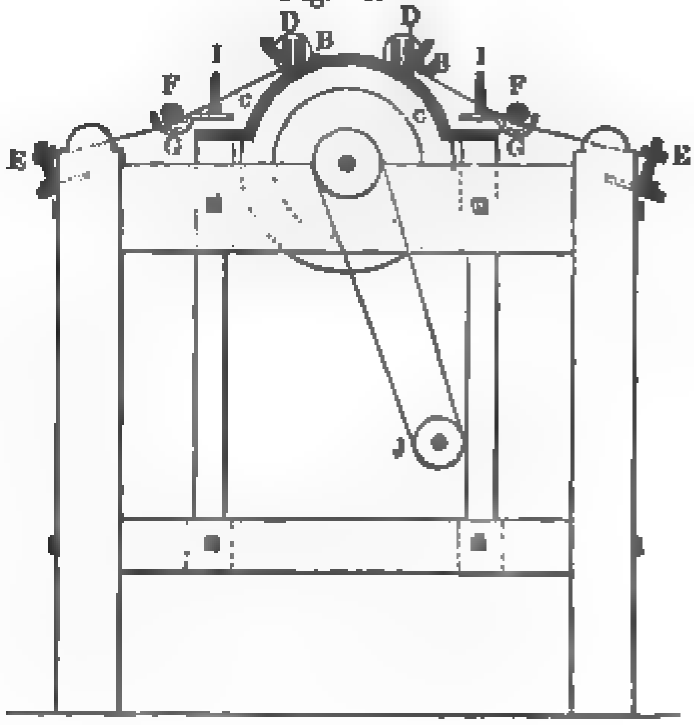
(see D D, Fig. 149.) Each spool has suitable iron gudgeons at its ends, serving as an axis on which it revolves (see Fig. 148.) E E are the bobbins from the spinning frame: F F are cylindrical pieces of iron covered with cloth, lying on the moveable rails G G. Pieces

Fig. 148.



of cloth are also fastened on the rails beneath the cleaners F F, so that the thread passes through between the two plies of cloth, which partly smooth down the fibres, and clean it from any loose specks that may adhere to it; I I are guide pins fastened on the rails G G (Fig. 149.) The pulley J, driven by a band from the cylinder shaft, is connected with a heart motion, which moves the rails G G alternately in a horizontal direction the full length of the spools, and by means of the guide-pins I I, causes the yarn to wind on equally from end to end of the spools. Each of the drums A is covered with cloth or leather, and requires to be perfectly true, as otherwise it would give a vibratory motion to the spools while the yarn is winding on.

Fig. 149.



This machine is extremely light, simple in its construction, and easily kept in order. A machine containing twenty drums may be attended by two girls of twelve years of age, and is capable of winding 3,000 hanks per day of 12¼ hours.

Instead of winding the yarn off the small bobbins on to others of a larger size, it is common in a number of factories to take the bobbins direct from the spinning frame to the warping machine, which is mounted with a rack or creel suited to the size of the bobbins. This creel, rack, or bobbin frame, is attached to the back of the warping machine, and lies in a horizontal position, but is hollowed in the centre like a cradle; hence it is denominated the cradle warper. The girl who attends this machine stands with her face towards the back of the warper, having the bobbin frame intervening; she thereby has all the bobbins within her reach, so that whenever she perceives one nearly empty, she is ready to remove it, replace it with a full one, and tie the two ends of the thread, without stopping the machine. And owing to the number of bobbins in the frame, and the small quantity of yarn contained on each, they are constantly emptying, while the attendant is constantly supplying their places with full ones; but in order to prevent them from running out entirely, she requires to take out a considerable number before the yarn is completely wound off. The yarn, therefore, which is left on the bobbins, if not wound off at some other machine, is liable to be made into waste. Hence the cradle warper has not been generally adopted, as it has been found that the loss from the quantity of waste made by it, is greater than the expense required for spooling, or winding the yarn from small bobbins on to others of a larger size, suited to the common bobbin frame of a warping machine.

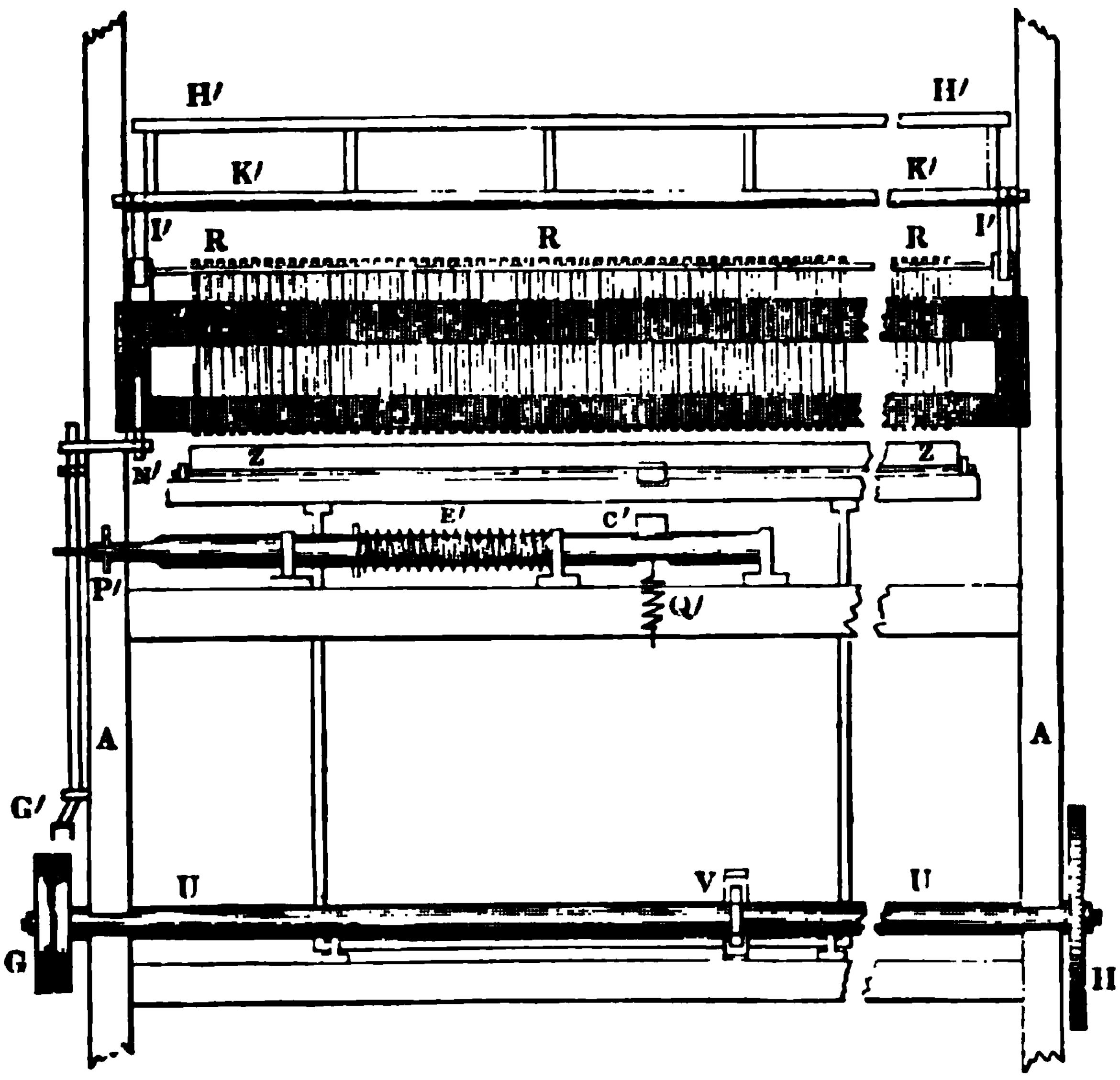
The next step preparatory to the operation of weaving is the formation of the warp or chain, that is, the longitudinal threads of the web, which lie parallel to each other through the breadth of the cloth. The bobbins are transferred to the warping machine; and though this machine is very simple in its construction, yet it is well worthy our notice.

WARPING MACHINE.

The species of warping machine which we shall now endeavour to explain is an American invention, and is far superior to those used in Great Britain; for it has the advantage of being provided with an

ingenious contrivance by means of which it is instantly stopped on the breaking of a thread.

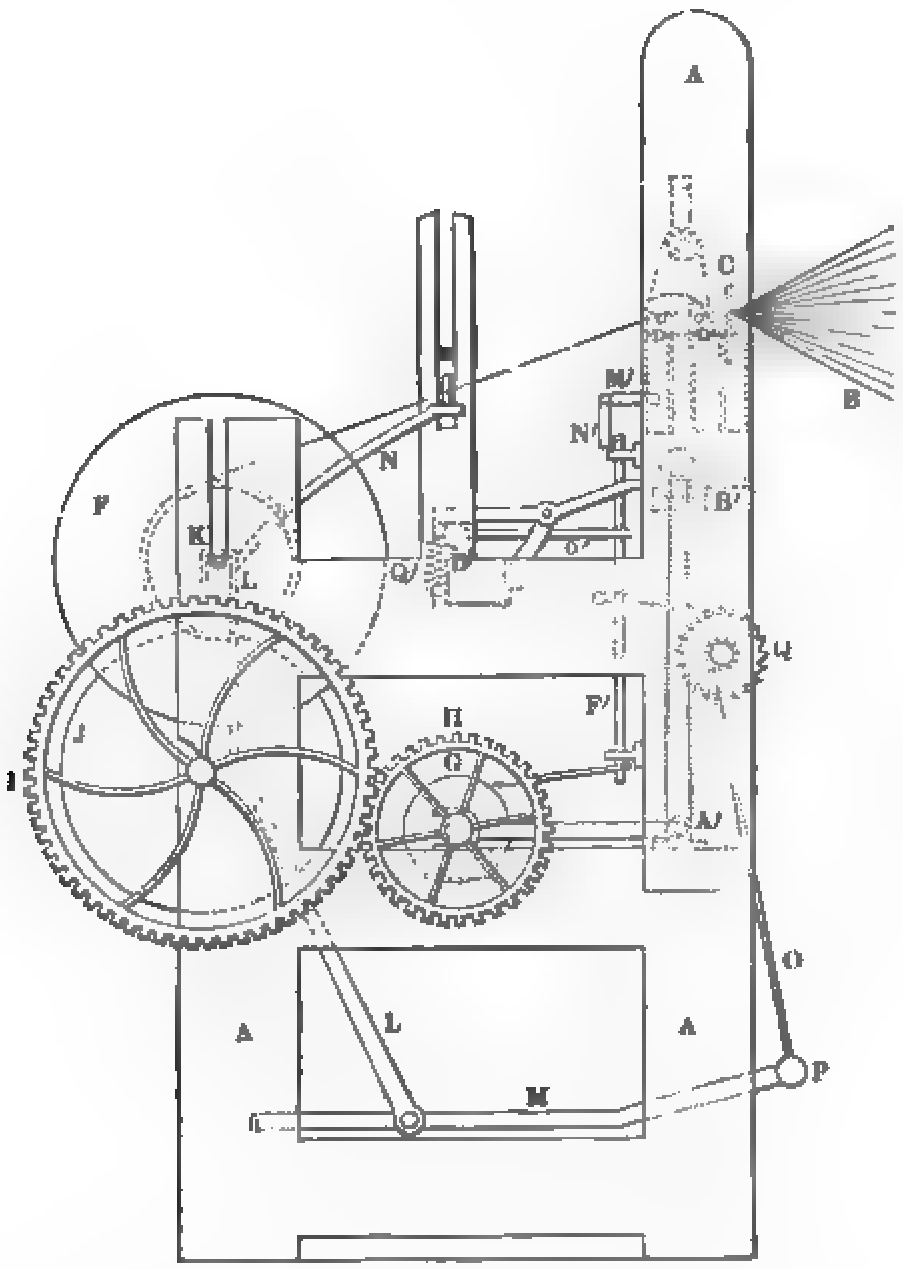
Fig. 150.



A A, Figs. 150 and 151, is the framing of the machine, which being constructed of wood, gives it a heavy appearance in the drawings; B Figs. 151 and 153 are the threads proceeding from the bobbin frame to the iron plate C, where each thread is separated; the plate C being perforated with small holes corresponding to the number of threads to be wound on the beam. Passing the plate C, where all the threads are brought into one horizontal plane, they thence pass over the rods D D: from these through the guide-reed E and on to the beam F, which is represented as containing only the first round of the yarn. The belt pulleys G are on the same shaft with the wheel H, which drives the wheel I; on the same axis with the wheel I, is the drum J, which drives the yarn beam F. The drum J, on which the yarn beam rests, and by which it is moved, is exactly one yard in circumference, and upon one end of its axis, there is a screw working into small geared wheels connected with an index, which indicates the revolutions of the drum during the warping of each beam, from which the length of yarn on each beam is ascertained, and the attendant is paid accordingly. The axis of the yarn beam rests on two slots of the framing at K, and is pressed down upon the drum J, by the stirrup L L, which is also weighted down by the cross lever M. From the top of the

stirrup L, an arm N extends to the guide reed E, so that as the yarn fills on the beam F, it gradually rises, and the arm N presses up the guide reed with the same gradual motion, so as to keep it always in a proper position in relation to the increasing diameter of

Fig. 151.



the yarn beam: O, Fig. 151, is a strap attached to the weight P, and which winds round a small shaft, on the end of which the ratchet wheel Q is made fast. When the beam is sufficiently full, the strap O is wound up by means of a wrench attached to the ratchet wheel, which thereby lifts the weight P, the lever M and stirrup L, until the hook on the axis of the yarn beam at K, is so far relieved as to be pressed back: the full beam is then removed, and an empty one put in its place—the stirrup is brought forward till the hook is above the axis of the beam—the catch of the ratchet wheel is lifted—the strap unwound—and the machine is then ready to warp another beam.

From the foregoing description, it will be seen that this warping machine differs very little from those used in Great Britain. It is however in every respect as simple and efficient, besides having the advantage of the stop-motion; and which will now be described.

As the yarn from the bobbin frame enters the plate C, it passes over the rods D D; but between these rods, there is a drop-wire suspended upon each thread: these drop-wires are pieces of flattened steel wire, about four inches long, from $\frac{1}{8}$ to $\frac{3}{16}$ broad, and $\frac{1}{16}$ of an inch thick: their weight varies from 4 grains 4 dwts. to 4 grains 10 dwts. They are hooked at the top, and suspended by their own weight on each thread. (See R R R, front view, Fig. 150, and R, Fig. 153.) When the machine is in operation, the drop-wires are borne up by the tension of the threads, but as soon as any one thread breaks, it slackens, and, of course, the wire drops down till the point of the hook at S, Fig. 154, rests on the plate T T, Fig. 153; and it is this dropping down of the wire that stops the machine. The shaft U U extending across the machine, has an eccentric at V, Figs. 150 and 153, which works into the fork of the lever W W. On the top of the lever W W, there is a small tumbler X Y X attached to the steel plate Z, Figs. 150 and 153. The lever W W turns upon a journal at A′, Figs. 151 and 153; and in consequence of the eccentric V working into the fork, the top of the lever, and with it the tumbler X Y X, and the plate Z are made to oscillate under the drop-wires; so when a thread breaks, the wire drops down, and retards the oscillating motion of the plate Z, which immediately depresses either end of the plate X X of the tumbler, which again presses down the lever B′ C′ at B′, and raises the other extremity at C′. By lifting the lever at C′, the rod D′ D′, being then disengaged, is operated upon by the spiral spring E′, Fig. 150, which causes it to shift so far as to act upon the upright rod F′, and turn it round as far as to make the belt lever G′, shift the belt from the fast, on to the loose pulley. And as these various parts are fitted so as to operate all at once, the machine upon the breaking of one thread will be instantly stopped.

When the broken threads are all tied, and the machine ready to be put in motion, the girl attending, lays hold of the rail H′ H′, Fig. 150, and pulls it forward; I′ I′ are straps of leather fastened to the wooden frame J′ J′, containing the drop wires; therefore, by drawing down the rail H′ H′, the shaft K′ K′ turns round, and causes the straps I′ I′, to raise the frame J′ J′ so far as to lift all the drop-wires above the top of the plate Z, which keep their places by the tension of the yarn, as soon as the machine gets into full operation. In

lifting the drop-wire frame J′ J′, it also draws up the point M′, of the small lever M′ N′, Figs. 151 and 153, which causes the other extremity N′, to operate upon an arm of the upright rod F′, and turn it round as fast as to let the belt lever G′, shift the driving belt from the loose, on to the fast pulley: at the same time another arm O′, of the upright rod F′, Fig. 151, also operates upon the rod D′ D′ at P′, Fig. 150, and shifts it to the right hand, until the point C′ of the lever B′ C′, drops into the square groove seen in Fig. 150: the lever or catch C′, is kept in the groove of the rod D′ D′, by the small spiral spring Q′. Thus by pulling forward the rail H′ H′, the drop-wires are lifted, and the whole machine is instantly put in operation; and by lifting the catch C′, the rod D′ D′ being operated upon by the spiral spring E′, it is instantly stopped.

Figs. 152, 153 & 154.

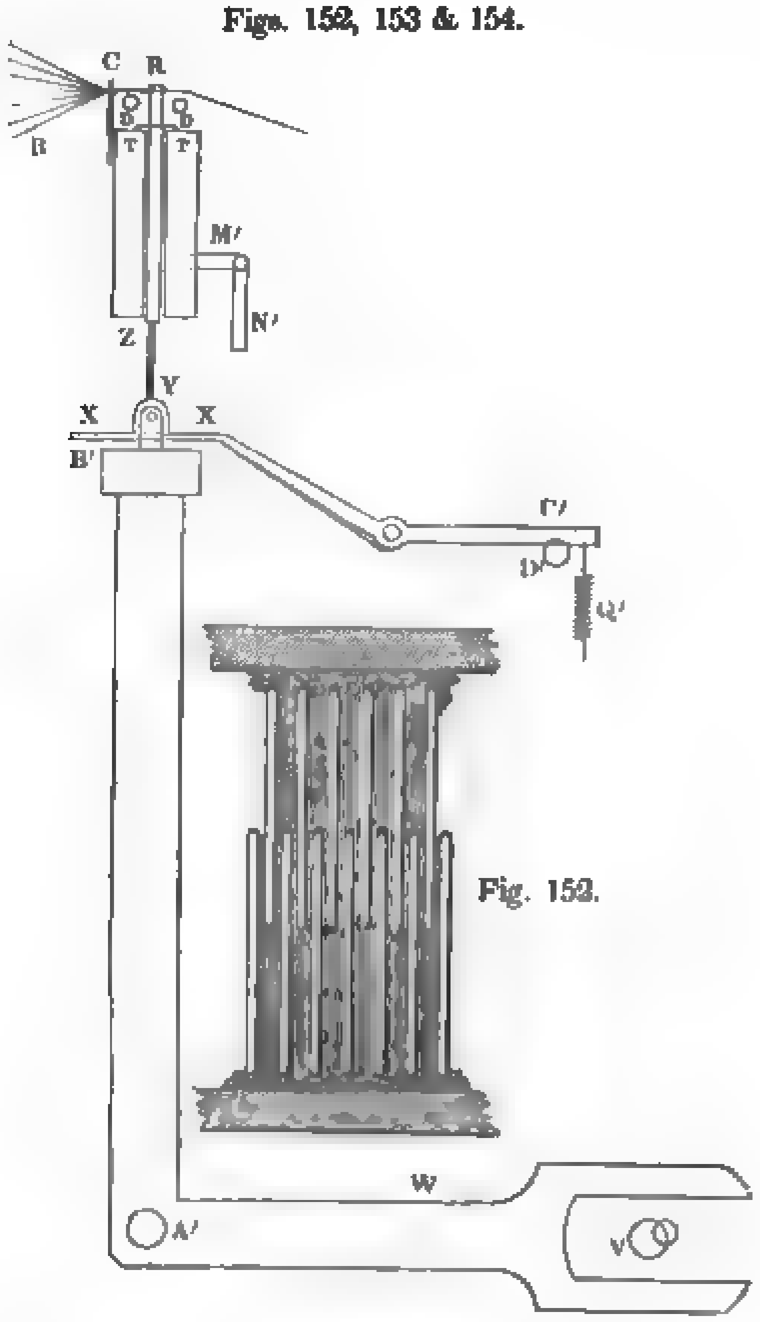


Fig. 154.

Drop wire of one fourth the working size.

Fig. 152 is a front view of the guide reed E, seen in Fig. 151, for directing the yarn on the beam F: it consists of a piece of sheet iron cut into a number of slits, corresponding to the number of threads to be warped on the beam. By examining the figure, it will be seen that the slits are so contrived, that a lease may be formed on each beam if necessary.

In looking at the representations given of this machine, those unacquainted with it might be apt to suppose, from the number of levers, springs, &c. depending upon each other, that it would work inaccurately, and be difficult to keep in order. This, however, is not the case. The warping machines used in Great Britain require the utmost attention on the part of the attendant to notice instantly when a thread breaks; as should her eye be diverted from her work but one moment, the end of a broken thread might wind round the beam so far, as to require five minutes or more to find it, and put the machine again in motion. But this is not the case with those used in America; for while the machine is in operation, the attendant is frequently behind the bobbin frame, taking out empty spools, and supplying their places with full ones; nor could the cradle warpers of America be used, except by being furnished with a self-acting stop-motion. This motion is, therefore, eminently entitled to the appellation of an important labour-saving improvement.

The above account of the American spooling and warping machines, is principally abridged from the able descriptions given by James Montgomery, Esq., in his excellent work, entitled, "The Cotton Manufacture of the United States of America contrasted and compared with that of Great Britain."

We close this part of our subject with a remark or two regarding the warping and beaming of silk webs:—

1st. In warping silk webs where the warp is to consist of different grists or colours of yarn, as in stripes, ginghams, pullicates, &c., the bobbins must be arranged in the creel or bank agreeably to the order in which they are indicated in the draught or design.

2d. A silk warp to make taffeta, must not be put on the same roller or beam with one to make gros de Tours serge, satin, &c., but each must have a separate and distinct roller for itself; and they must be weighted according to the nature of the texture to be produced.

3d. A warp making the same pattern in several places in the web, but double-threaded in one place and single in another, must not be all put on the same roller or beam; because, the different

parts would not work equally tight in the weaving, as the double-threaded part would be much larger on the roller than the single.

SIZING.

Since the invention of the common dressing or sizing machine, in 1802, by Mr. Thomas Johnson, an ingenious mechanic of Bredbury, a great many different contrivances have been tried to facilitate the operation of sizing; but most of them have sunk into oblivion. It will be our object, in this place, to describe only those which are likely to prove beneficial to the manufacturer. The first of these which we shall consider, is of the invention of Mr. John Potter, of Manchester; and the second, of Messrs. Hornby and Kennyworthy, manufacturers, Blackburn.

Mr. Potter's improvements in the process of preparing warps for the loom, consist; firstly,—In certain variations in the construction of the ordinary dressing machine, by means of which, the manufacturer is enabled to dress warps which have previously undergone the process of sizing,* so as to produce a warp more capable of enduring the subsequent friction in the process of weaving; and, secondly, In the construction and arrangement of a new machine for the purpose of producing a warp of greater length, and thereby obviating the necessity of joining or twisting in the warp so frequently as is the case when a warp of the ordinary length is used. The same letters and figures of reference indicate the same parts throughout.

Fig. 1, Plate 3, represents a side elevation of a dressing machine to which part of these improvements is applied; and Fig. 2, is a plan of the same. In operating with this machine, it is usual to place the yarn on six or eight beams, from which it is drawn off and combined in the process of dressing to form the warp; but in Mr. P's machine, the warp, in a ball (as taken from the drying house,) is placed at the point A, and the end of the warp, in a sized state,

* The common sizing machine consists of a trough filled with size, through which the warp is drawn; but instead of passing the warp simply through the size, it is made to pass under and over a series of rollers, having suitable gudgeons and bearings at their ends, rotary motion being communicated by the friction of the travelling warp as it is drawn away from them. After having passed this series of rollers, the warp is squeezed between two large wooden rollers or cylinders, which expel the superfluous moisture. It is then passed over the cylinders of a common drying machine, similar to those used by calico printers, when it is finished.

is carried over the rest or guide B, and between the pressing rollers C and D, thence round the stud E, and back under the roller D, passing again between the pressing rollers C and D, and over the upper surface of the roller C. From this point it is carried forward over the rollers F, G and H, till it arrives at the horizontal position, where it is traversed in the direction of the arrow through the ravel H^1, suspended from above, so as to yield to any impediment which may arise in the warp, and forward, between the stiffening rollers I I, whence it proceeds under the brushes K, and is taken up on the warping beam of the loom, as in the ordinary dressing machine. M, is the driving pulley, and motion is imparted to the various parts in the common way. Now it is well known to weavers and persons conversant with the preparation of warps for the loom, that the adhesion of various threads of sized warp, would cause great difficulty in passing it through this machine with any degree of regularity. To obviate this difficulty and separate every thread, two rods L L, are passed through the openings of the lease which has been secured at the warping machine, as best seen at Fig. 1. These rods L L, are attached to the shaft or rod M^1, (see Fig. 2,) through which they receive an alternating motion from the arm N, which is vibrated by the connecting rod O, driven from an eccentric on the face-plate P, as seen in Fig. 1, where the varying position of the rods L, will be seen dividing the threads or ends of the warp in its progress towards the rollers I I. In Fig. 4, the process of opening or separating each thread of the warp is effected by means of the two blades Q Q, which move on centres at their respective extremities, and are vibrated by the arms N N, as in Figs. 1 and 3. The warp in a sized state, being placed on the beam R (Fig. 3) in the ordinary manner, practised with sized warps and held back by the friction strap and weight R^1 and R^2, which gives off the warp at a proper tension as the dressing proceeds. The vibrations of the rods L L (Figs. 1 and 2) and the blades Q Q (Fig. 4) in these machines depend on the revolution of the eccentric P (Fig. 4,) which may be driven at a speed of 210 revolutions per minute; but the speed may be varied according to the nature of the work in the machine.

Fig. 5, represents an elevation; Fig. 6, a plan; and Fig. 7, a side view of a machine for forming the warp on a beam previous to the sizing process. In this machine, S (Figs. 5 and 6) represents a cone drum, which is driven by means of a strap, the velocity varying according to the diameter on which the strap is placed. On the extremity of the shaft on which the cone S is fixed, is attached a

spur-wheel T (Figs. 5 and 6,) which drives the spur-wheel U, fixed on the end of the shaft V, carrying a succession of small beams W, divided by the flanges. On to these beams W, the warp is received from the heck X, as seen at Fig. 5, and regularly distributed by means of a small ravel X^1, which is traversed by a worm and worm-wheel, as shown in Fig. 6, and in side view at Fig. 7, where the direction of the yarn will be seen passing over the guide roller X^2, and under the roller X^3, and thence to the beam W (Fig. 7,) at the same time that it is compressed into a hard state by the cylinder Y, which acts as a pressing roller during the operation. This pressing roller Y, along with the arms in which it is supported, move freely on the rod Z Z (Figs. 5 and 6,) so that as soon as the first small beam W, is full, the operator raises the presser Y, and passes it forward to the next, and so on till the whole series of beams W, are filled and equally pressed, at the same time securing a lease in the yarn of each beam, as already alluded to, for the action of the rods L L, or Q Q, in the dressing machine. It will be also remarked that the heck X, is moved in the frame in which it is supported, so as at all times to correspond with the position of the presser Y, when placed on any of the various beams W, in the process of filling. Returning to the cone shaft which carries the wheel T, will be seen a small worm *a*, driving a worm-wheel on the upright shaft *b* (Fig. 5,) which is also provided with a worm driving a worm-wheel on the horizontal recording shaft *c*. This shaft *c*, carries two circular discs *d* and *e*, the position of which will be seen in Fig. 6. The disc *d*, is provided with a small lever which rests upon it during the winding process of the cone S, and the speed of the disc *d*, is so calculated as to make one revolution during the winding on, or filling one of the beams W, with warp, but when that is effected a notch or gap in the disc *d*, allows the lever *f*, to fall by means of the weight f^1 (Fig. 5) which tightening a strap-break on the pulley *g*, placed on the cone shaft, arrests the revolution, and thereby distributes an equal quantity of warp on the various beams W, as they are filled in succession. The disc *e*, is provided with a series of notches or gaps, and supports a lever *h*, which acts on the marking rod *i*, by means of a spring *o*, placed on the perpendicular rod by which the weight *m*, is supported (see Fig. 6.) The extremity of the opposite arm of the rod *i*, passes under the edge of the warp, and is provided with fibrous material, saturated with marking ink which marks the warp every time the lever *h*, is allowed to fall into one of the notches in the disc *e* (see Fig. 5,) into which it is forced by the weight *m*, at the same time the marking

rod *i*, having made the mark, is replaced in its former position on a stud or rest, by the action of a spiral spring *o* (Fig. 5,) the mark on the warp, indicating a uniform and equal amount of warp placed on the beam W. The distance of the notches on the disc *e* (Fig. 5,) are calculated to compensate for the increasing diameter of the warp on the beam W, during the filling process. The varying taking up of the warp on to these beams W, according to their increased circumference, is compensated for by traversing the driving strap to a larger diameter of the cone S (Figs. 5 and 6,) and the velocity must depend on the nature of the work and the judgment of the operator. By tracing the action of this warping machine, it will be obvious that the beams W, may be multiplied to any convenient extent, and consequently the length of the warp, which necessarily effects a great saving in joining or twisting in, as practised in the ordinary warp.

In Fig. 6, it will easily be perceived, that motion is transferred from the cone drum S, to the yarn beams W, by the spur wheels T and U. The notched disc *e*, is left out in the plan view (Fig. 6,) to avoid confusion, and more clearly to show the levers *e'* and *d*, weight *m*, and marker *i*. Should the marking apparatus shown in Figs. 5 and 6, be considered too complicated, one of those in common use may be easily substituted in stead.

We now pass on to describe Messrs. Hornby and Kennyworthy's machine for sizing and preparing warps for the loom; which, from its neatness, the regularity of its motions and the work which it is capable of performing, is well worthy our attention in this place.

The improvements in this machine, consist in a novel and particular arrangement of mechanism for sizing and preparing warps from "beam or machine warping."

The principal feature of novelty and improvement in Messrs. H. and K's. method of sizing or dressing warps, consists in a peculiar mode of distributing or laying out of the threads, so that they shall be dressed or sized in parallel strips or breadths, laid in even and close contact, side by side, and usually termed "beers or half beers" in the ordinary warping mill. (See common warping mill, Section First.)

This new method of dividing and laying out the warp threads into strips, bands, or beers and half beers, *during the process of sizing and preparing them for the loom*, possesses many advantages, which will be evident to persons conversant with the ordinary modes of conducting such operations. As the threads are divided into certain numbers, forming a beer or half beer, and in that

breadth passed through the sizing substance, they retain the form of bands or strips, and are slightly attached to each other by the adhesion of the size, thus forming narrow tapes or breadths of warp threads, and consequently rendering them more tenacious than if passed through the sizing and preparing process in single threads, as commonly done, and allowing them to be more easily conducted through the machinery. The warps may be thus extended to a much greater length than usual, and the process of taking the "lease" and winding on to the warp beam ready for "looming," can be effected by the arrangement of one and the same machine, with more expedition than by the ordinary method now in use.

One of the improvements connected with the working of the machinery, is a new arrangement of the headles for obtaining the lease or cross shed of the warps, previously to the dressing, sizing, or drying of the same, that is placing the headles, for dividing the shed of the warps, *at the entrance end of the machine*, or at the commencement of the operation; and the further improvements in the machinery for sizing and preparing warps, consist *in a novel form of ravel or comb*, for allowing the lease band to pass through the warps without the necessity of having the whole of the half beers or breadth relaid each time of taking such lease or cross shed; and also in the application of a *revolving self-acting marker*, for marking off any required length of warps, as they are wound on to the warp beam, ready for looming.

In Plate IV, Fig. 1 represents a plan or horizontal view of the machinery in which these improvements are shown; Fig. 2, is a side elevation; and Fig. 3, a vertical section of the same, taken longitudinally through the middle of the machine. The main and side framings of the machinery are shown at *a, a, a, a*, which support the beams of warp or yarn *b, b, b, b, b*, previously wound and prepared by the warping machine: these main side frames also support the various ravels or combs, headles, sizing or dressing trough, the drying cylinders, tension and guide rollers, and also the driving apparatus for giving motion to the mechanism.

It will be perceived, that as the unsized warps proceed from their respective beams *b, b, b, b, b*, they are guided on to, and passed through an ordinary ravel or comb *c, c*, and thus divided equally, prior to their being passed through the headles *d, d*, situated at the entrance of the machine, for the purpose of effecting the cross shed, and thereby taking the lease previously to the yarns being submitted to the sizing process. The lease now being taken, and the cross band or threads introduced, for the purpose of looming or drawing

in of the warp through the headles, as is well understood, the yarns or warps are passed through a ravel or comb *e*, (see Figs. 1 and 2,) formed by a rack of teeth or pins and intervening spaces, for the purpose of dividing and laying the warps in parallel breadths, side by side, and forming each division, strip or band of warps, (of any required number,) into separate and distinct tapes or sheets, (of any desired width,) each thread being laid parallel, side by side; and thus, in close lateral contact, the ravel or comb *e*, either being allowed to vibrate or oscillate freely as the warps proceed over it, or it may be caused to revolve, if found more desirable.

The continuous warps being thus made or separated into breadths or bands A, are now passed over a conducting roller, and immersed into the trough or vessel *f* (see Fig. 3,) which contains the sizing material, and is to be kept in a heated state, by steam passing through the pipe *g*, *g*, or otherwise, and thus boiled into the warps as they pass through it, and under the tension rollers *h*, *h*, (see Figs. 1 and 3): it will be observed that these tension rollers *h*, *h*, may be adjusted to any degree of tension, or raised up entirely out of the troughs, to be cleaned or otherwise, by turning the winch handle 11 (see Figs. 1 and 2,) which, by means of the worms and wheels 12, and pinions 13, 13, take into the racks 14, 14, in connection with which the pivots of the rollers *h*, *h*, are mounted. The warps are then to be passed forward through a pair of squeezing rollers, *i*, *i*, (Figs. 2 and 3) and again immersed in the trough or vessel *j* (see Fig. 3,) containing a similar sizing preparation, to finish the yarns; from thence the warp is passed around the drying cylinders *k*, *k*, (Figs. 2 and 3) also heated by steam through the pipe *g*, and discharged by the pipes *l*, *l*, or by any other convenient means. The yarn or warps, as they pass around these drying cylinders, will now be found to assume the form of tapes or bands, as the sizing material will cause the parallel threads, as they lay side by side, to adhere slightly together, and thus proceed in a tape-like form, being of course much stronger, more regular, and less likely to be broken or disarranged, than in the ordinary mode of sizing.

A brush 15 (Figs. 1, 2 and 3,) is placed over the yarns as they proceed over the cylinders *k*, for the purpose of dressing and laying the fibres of the threads, and making the tapes or bands more compact and even: it is caused to revolve very slowly by means of the small band 16 (Fig. 2,) proceeding upon the axis of the guide roller *m*, (Figs. 1 and 2;) the warps now proceed in a sized, dried, and finished state, conducted by the rollers *m*, *m*, through a similar ravel or comb *n*, *n*, (Figs. 1 and 2,) but of a finer rake or pitch

than the ravel *e*, *e*, and by passing through or over which, the strips or bands are turned edgewise, and again similarly dividing by the oscillating or vibratory action of this comb *n*, *n*, and laid over the tension roller *o*, *o*, (Figs. 1, 2 and 3,) in a proper state to be received and wound upon the warp beam *p*, ready to be removed and taken to the loomer or drawer in. The continuous operation of the machinery is effected by means of a strap passing around the driving pulley *q*, (see Figs. 1, 2 and 3,) upon the end of the transverse shaft *r* (Fig. 1,) being traversed from the loose pulley by the setting on rod *s*. Upon the shaft *r*, is also a conical drum *t*, having a driving strap passing around it, and the corresponding cone *u*, (Figs. 1 and 2,) mounted also upon a transverse shaft *v*, at one end of which there is a toothed pinion *w*, (Fig. 1,) driving the train of spur wheels *x*, *y*, *z*, which gives rotary motion to the warp beam *p*, causing it to wind on the yarn or warps as required. The yarn is kept distended and even, by means of weighted friction bands being passed around the ends of the warp beams *b*, *b*, and the pressure of the squeezers or presser rollers, is similarly adjusted, by means of the weighted lever 2 (Fig. 2.) The self-acting marking apparatus is shown in Fig. 1; upon the end of the revolving guide roller *o*, *o*, is a small worm 3, taking into a worm wheel upon the end of the shaft 4, at the reverse end of which is the mitre wheel 5, driving a corresponding wheel 6, upon the small shaft 7, which carries the revolving marker 8, which from time to time dips into a colour box, and marks the warp threads with a patch of colour as it revolves, any length for the pieces intended to be woven, and allowing the warp beam to contain accurate lengths, without waste in the looming.

In the detached Figs. 4, 5 and 6, are shown three varieties of the improved ravel or comb, (upon a large scale,) for dividing or separating the warp, as they pass through the machine. Fig. 4 shows one description, being that preferred to be used with a pendulous or oscillating motion; Fig. 5, another, which is preferred to be used as a rotary comb, and it will be perceived, that one set or rake of teeth will always be entering and dividing the warps, as those on the opposite leave them; Fig. 6 shows another modification of the same, which may either be used with a rotary or any other required motion.

If our manufacturing friends shall derive any real benefit from the description just given of these improved machines for preparing warps for the loom, we will not grudge the expense incurred on our part in rendering all the particulars as plain as possible.

PLATE III.

Fig. 1.

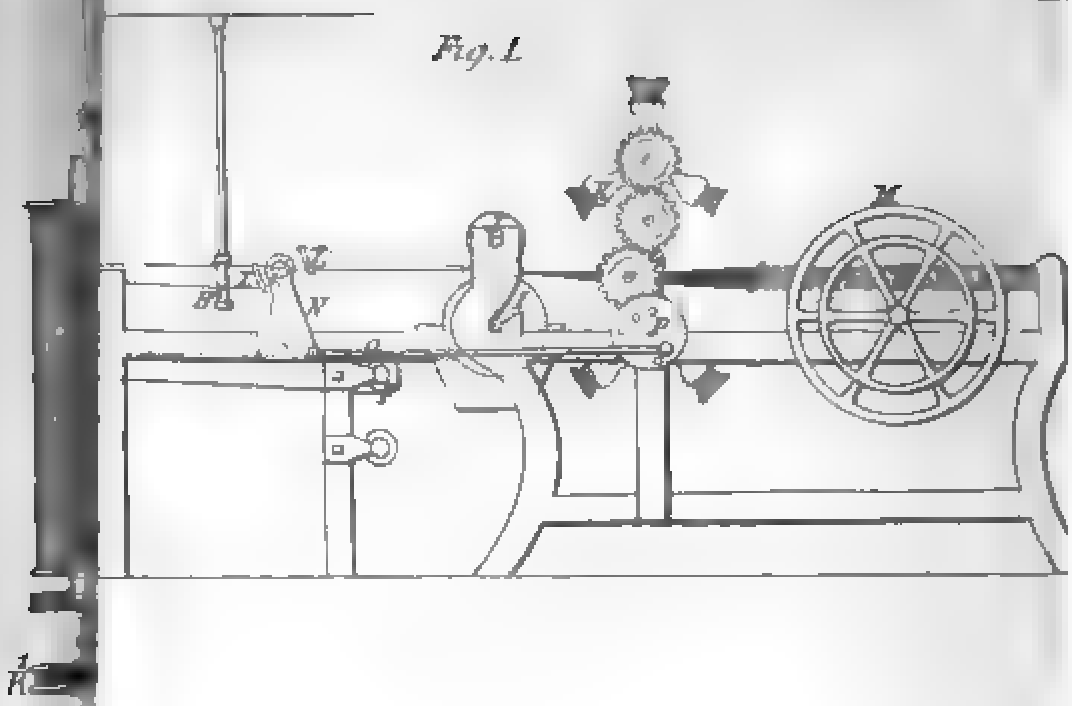


Fig. 2.

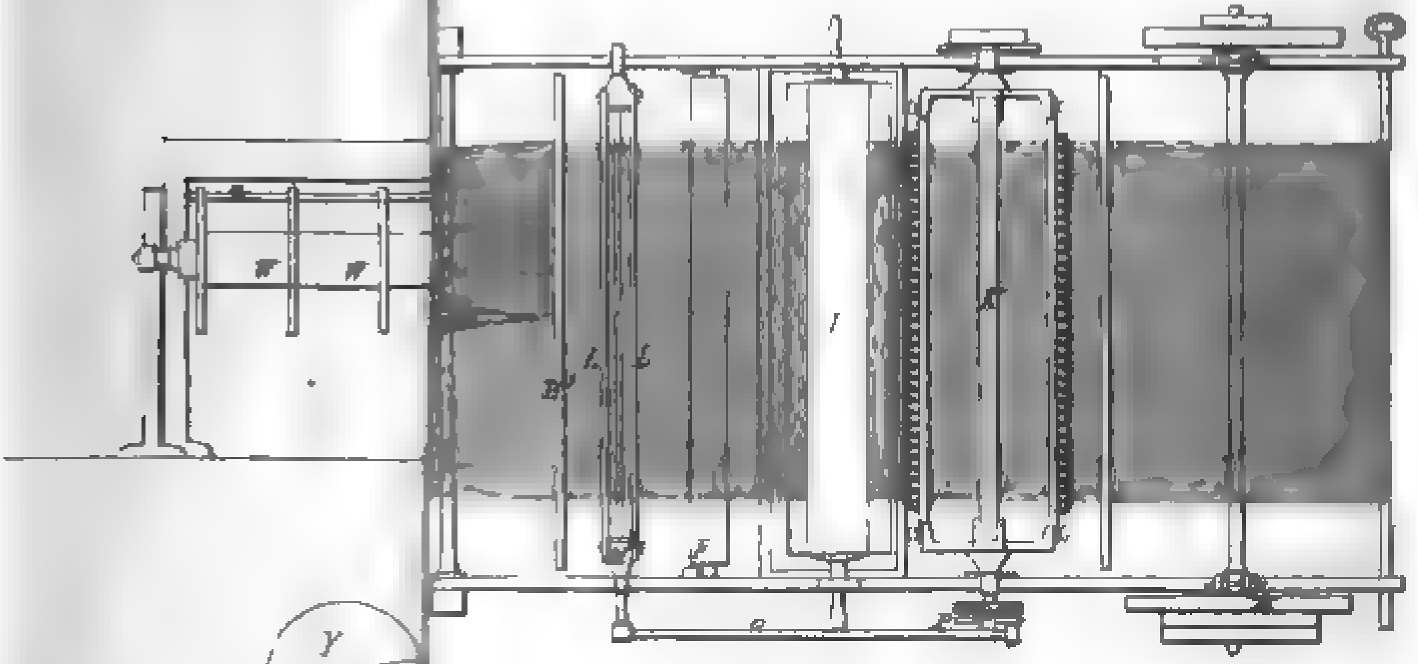


Fig. 3.

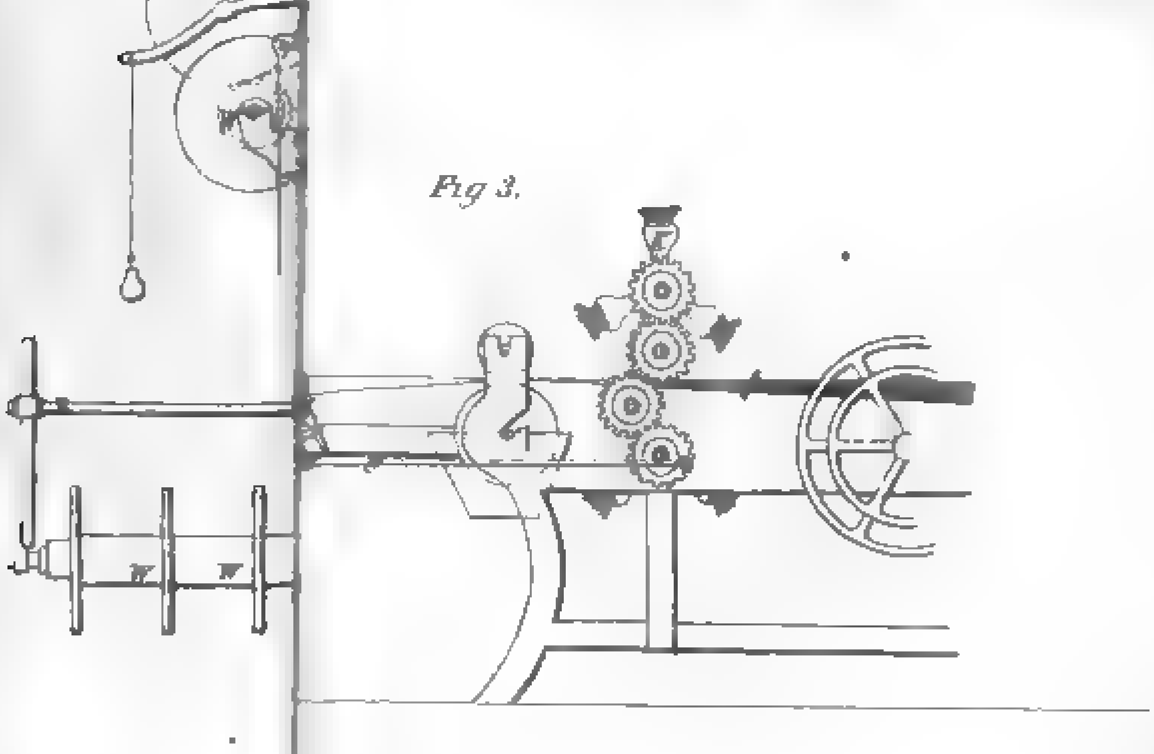
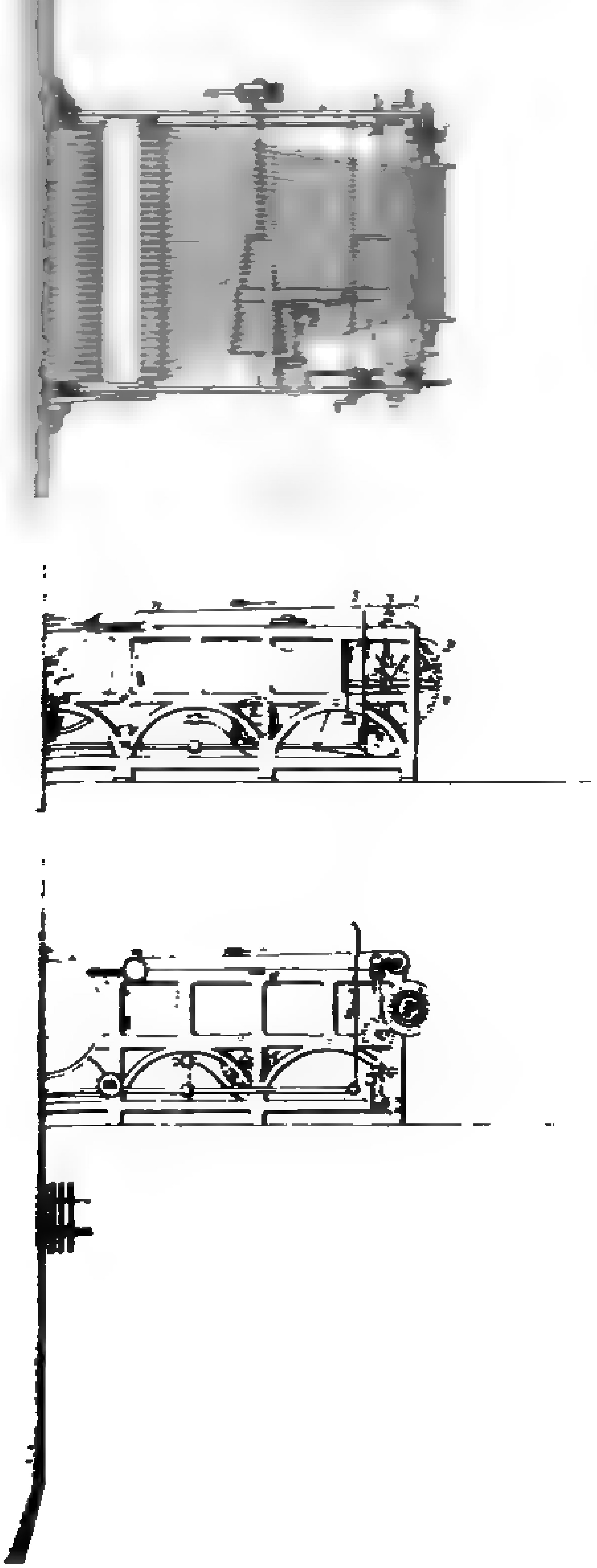


PLATE IV.



SECTION TENTH.

PLAIN WEAVING BY POWER.

Now the steam begins to blow;
Girl, haste, your loom attend;
Do not always be so slow,
Or your web will have no end.

Stay no longer idly singing:
You're a pretty girl, indeed!
Hark! the factory bell is ringing!
Mary, to your loom with speed!

See the shafts begin to move,
Driven by the power of steam;
Wheels below and wheels above
Turn correctly every beam.

Force is constantly supplied,
Brought by straps of leather strong;
Levers play on every side,
While the shuttle shoots along.

See how fast the lay is driven;
See the treadles sink and rise;
See how well the cloth is woven;
Gracious! how the shuttle flies!

BRIEN DHU O'FARRELL.

We shall not in this place give any repetition of the old hacknied story regarding the origin of the power loom (in Europe),* by Mr. Edmund Cartwright, of Marnham, Nottinghamshire; and for which he obtained a patent, bearing date 4th April, 1785. It is certain that this machine would have long since passed into oblivion, had it not been for the improvements made upon it by other men of genius. It was not until the year 1801 that power loom weaving began to be extensively introduced for the manufacture of plain goods; and not until the years 1830 to 1834 that it was successfully applied to light fancy fabrics, with small patterns, (say, of from 10 to

* For the true origin of power loom weaving (plain, tweeled and figured, of every description) see introduction to this work.

75 changes of design.) Since 1834, it has been still further improved by various ingenious individuals, both in Europe and America, so as to make it available in the manufacture of almost every description of figured textures, whether of cotton, silk, linen or wool. In the present section, we shall confine ourself to laying before our readers its application to the weaving of plain fabrics.

Fig. 155.

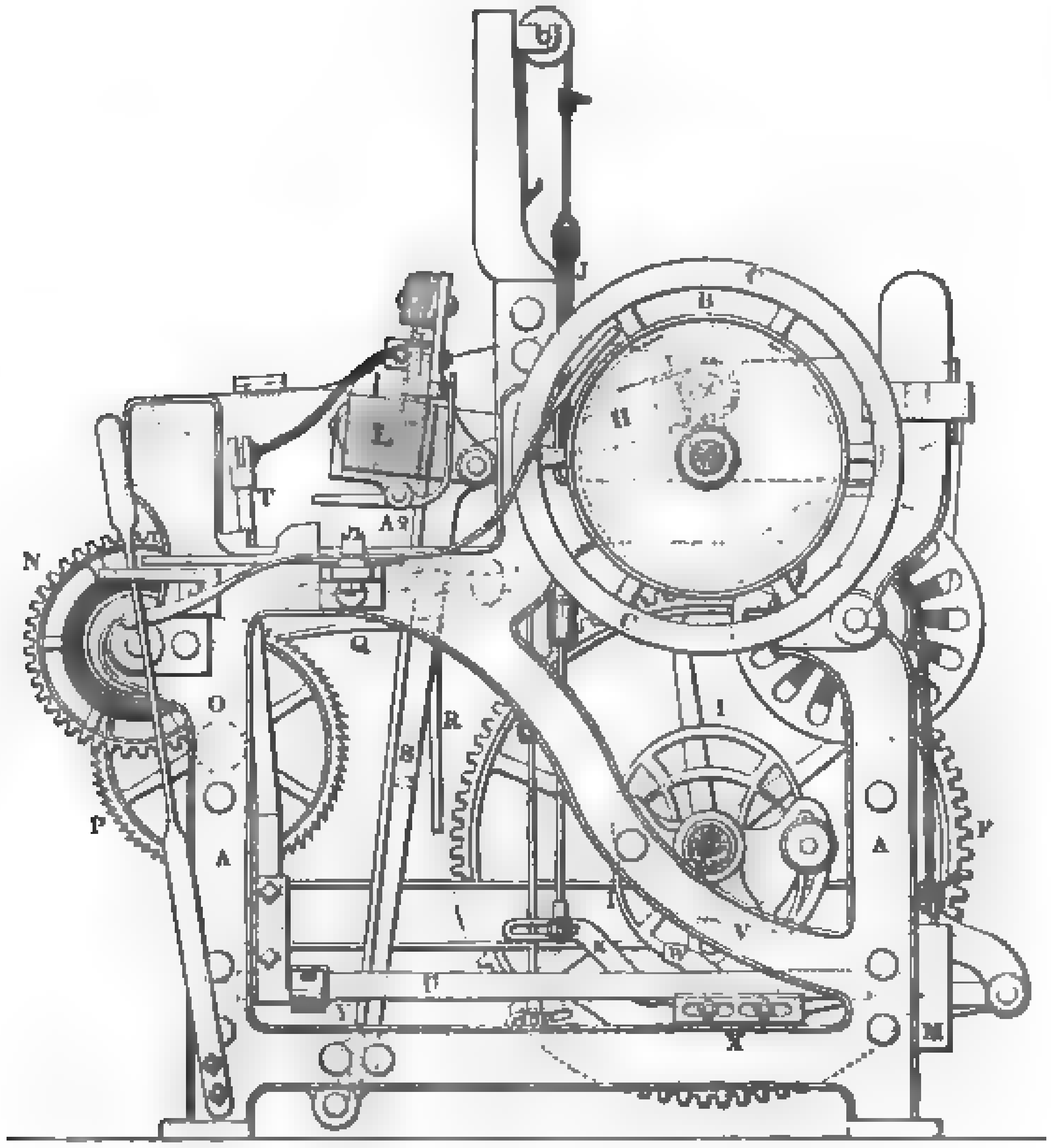
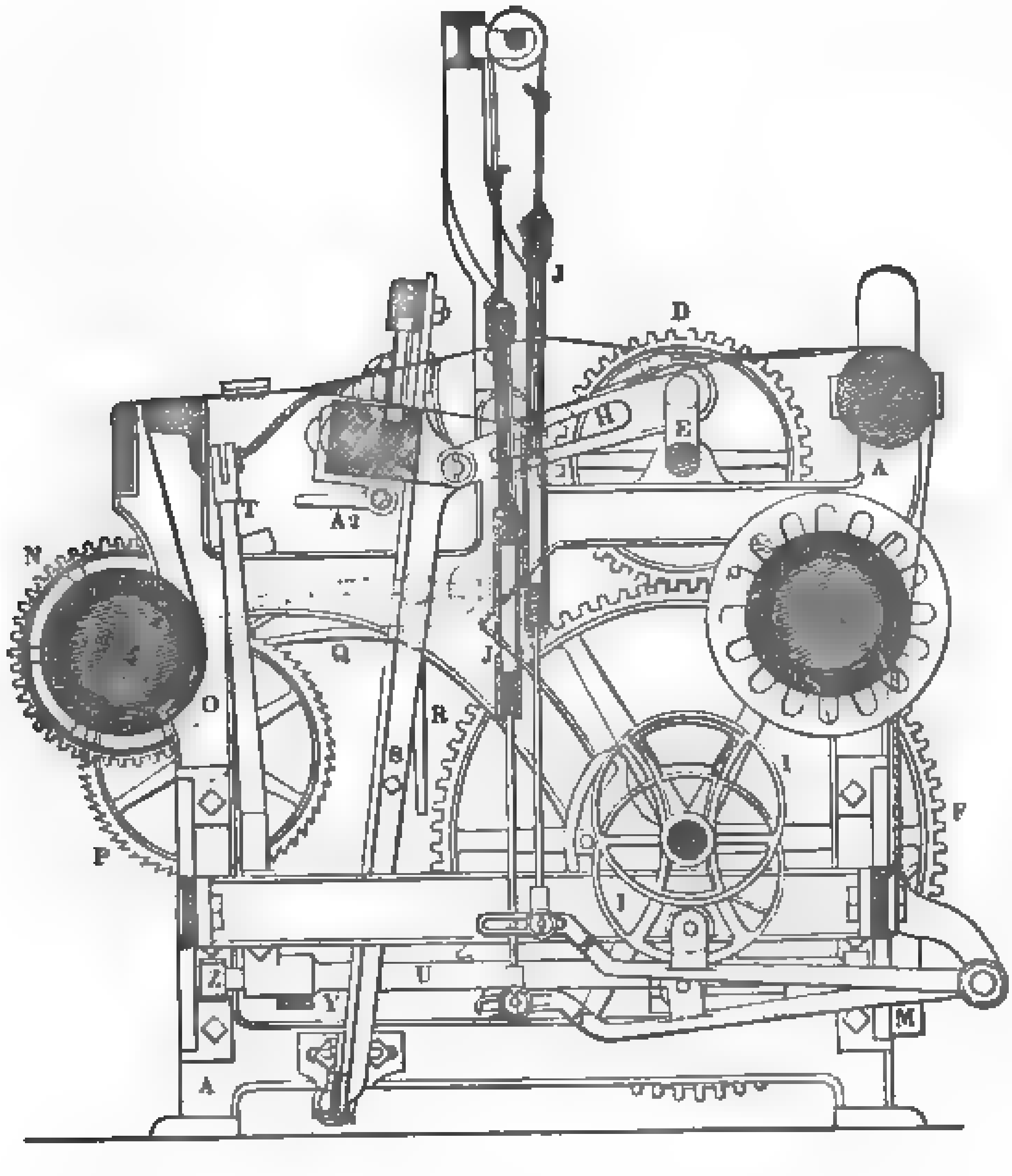


Fig. 155 shows a side view in elevation of the power loom, constructed by Messrs. Sharp, Roberts & Co., Manchester; but their machine contains no particular feature of novelty, we shall waste much time upon it. Fig. 156 is a section of the same ta through the centre, showing the interior working parts of the chine.

A is the frame work of the loom; B, belt pulleys (Fig. 155 fly wheel for equalizing irregularities of motion during the wo of the machine; D (Fig. 156,) driving spur-wheel, fixed o

crank shaft E, and gearing into the wheel F; this wheel F, has double the number of teeth of the spur wheel D, and consequently makes only half as many revolutions: it is keyed, or made fast, on the end of the cam shaft G; and it is by means of this shaft, in connexion with suitable tappets and levers, that motion is communicated to the headles for the purpose of shedding the warp, as well as for giving motion to the shuttle. The cranks of the driving shaft are connected to the swords of the lay by arms H (see Fig. 155.) The cams J J, give motion to the treadles K K, which work the headles J J, as will be seen very plainly in Fig. 156. The yarn beam is

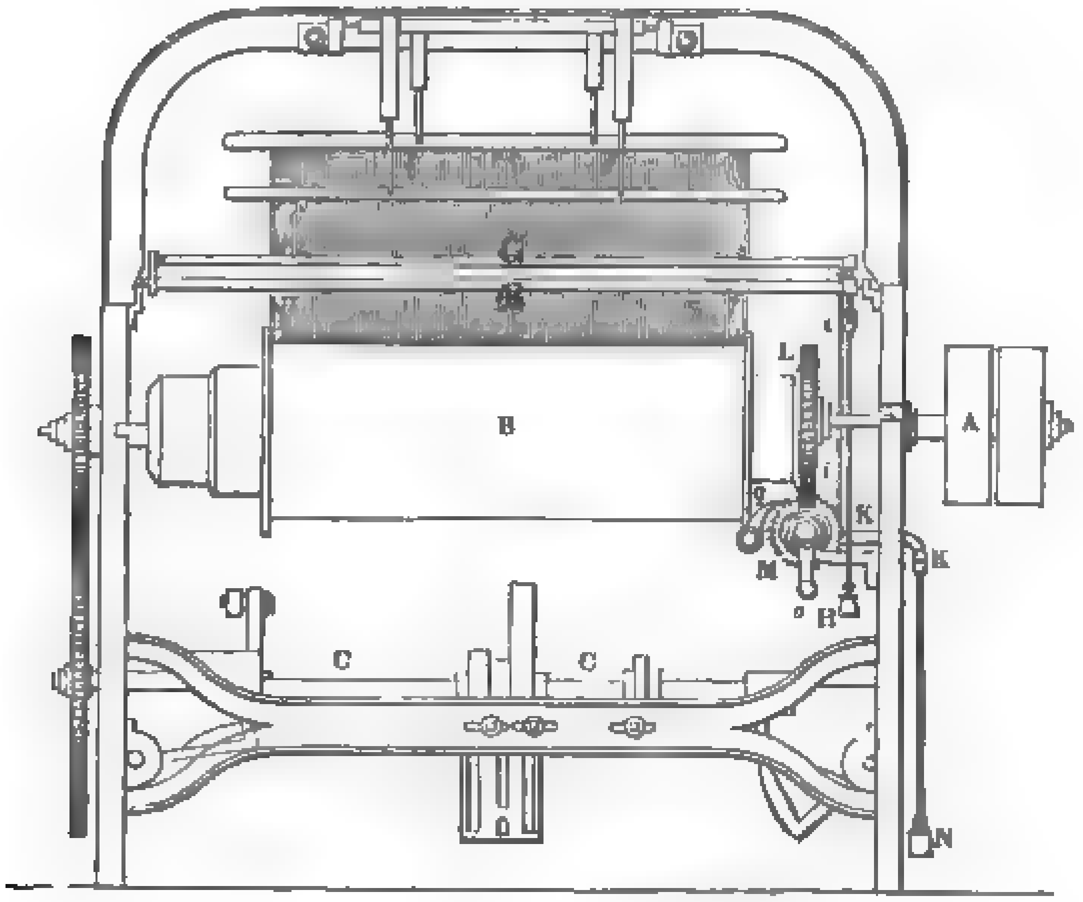
Fig. 156.



weighted in the ordinary manner used for coarse goods, namely, by passing a rope round the circumference of each end, to which rope a friction weight M, is attached. The cloth roller and take-up motion (as any practical manufacturer will perceive) possess no feature of novelty, consisting merely of a spur wheel N, working into a pinion

O, which pinion is made fast to the ratchet wheel P, and this wheel receives motion from the clicks or drivers Q, by means of the arm R, this arm receiving motion from the stud-pin S, fixed in the sword of the lay L. The shuttle is thrown by means of two levers T (one of which is seen in Fig. 155 and the other in Fig. 156,) connected at bottom with the horizontal shafts U, motion being communicated to these shafts by a wiper V, working against the iron shoe or slide W, (see Fig. 155.) The shoes or slides W, are bolted to the side of the horizontal shafts U (one at each side of the machine) at X. The picker staves or levers T, are recovered to their original positions, alternately, after having thrown the shuttle through the shed, by means of a leather strap and spiral spring which connects the horizontal shafts U U, together across the machine; the position of one end of this leather strap, as bolted to the horizontal shaft U, will be seen at Y, in both Figs. The shaft U, has suitable bearings at each end, which are indicated by the dotted lines in Fig. 155, and at Z, Fig. 156. The protector A^2, as seen in both these Figs. is of the ordinary construction. This form of the power loom being unworthy of further notice, we shall, therefore, pass on to describe others of greater merit proceeding gradually until we arrive at the most perfect.

Fig. 157.

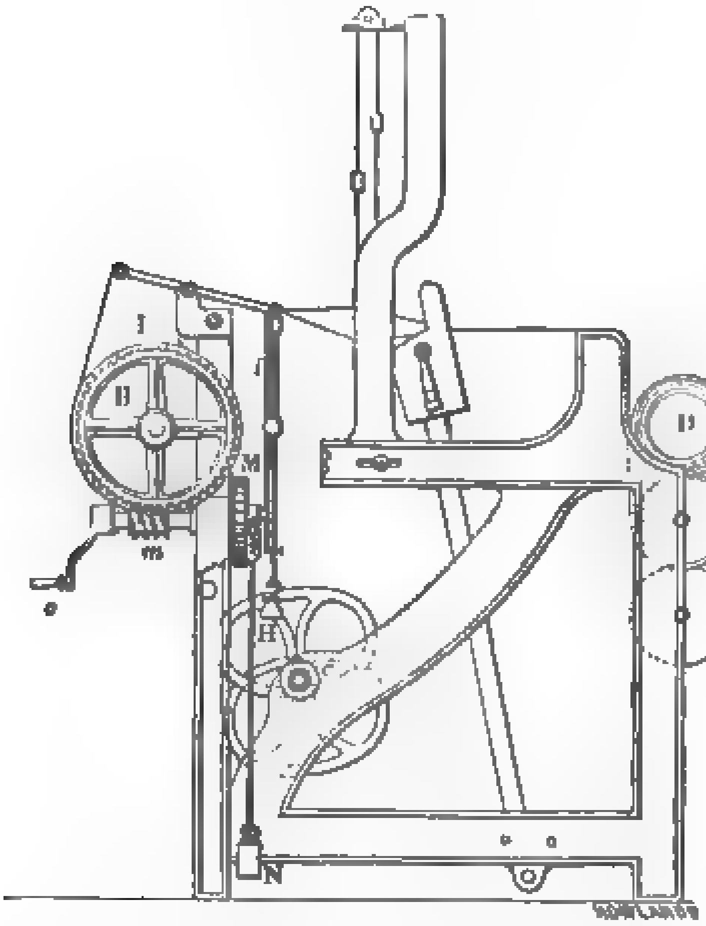


Figs. 157, 158, 159 and 160, show the different parts of a loom, as improved by Messrs. Apelles Howard, of Stockport, and John Scattergood, of Manchester.

Fig. 157 is a back view of the common loom; Fig. 158, a side view, in which part of the framing is removed for the purpose of making the application of the improvements more obvious; and Fig. 159, a view of the improvements apart from the loom, for the purpose of showing more clearly the nature and construction of the same. In Figs. 157 and 158, some of the ordinary parts of the loom are omitted, and only such parts delineated as we consider requisite to explain and show the position in which the improvements are applied.

In Fig. 157, A, represents the driving pulley keyed on the crank shaft, which gives motion to the lay; B, the yarn beam; D, Fig. 158, the cloth roller; and C, the tappet shaft by which the position of the headles is regulated, thereby producing the shed or opening in the warp for the passage of the shuttle at each vibration of the lay. In Figs. 157 and 158, E represents a shaft

Fig. 158.



supported at each side of the loom, parallel to, and immediately above the yarn beam B: on this shaft is made fast two arms F, and F'. The extremity of the arm F, carries a shaft G, similar to that marked E, and crossing the loom in the same way: the shaft E

moves freely on its axis. The direction of the warp threads from the yarn beam B, will be seen in Figs. 158, 159 and 160, proceeding first over the shaft or roller G, and under the shaft E. To the arm F′, is suspended a small lever or rod which supports the weight H, as best seen in Figs. 158 and 159; this arm also carries a perpendicular rod *i i*, which moves freely through an opening or hole in the lever K, beneath (Figs. 157 and 158.) L, represents a worm-wheel attached on the axis of the yarn beam B; and *m*, a worm or screw taking into the wheel L (Figs. 157 and 158.) On the same shaft which carries the worm or screw *m*, is placed or keyed the ratchet wheel M, and also the vibrating lever K, which is not keyed but perfectly free, sliding in a suitable slot. The lever K, is provided with a catch or dog *q*, taking into the ratchet wheel M, (Fig. 157,) and at the other extremity with a rod suspending the counter weight N, as seen in Fig. 158. By retracing the action of the various parts which we have last described, it will be obvious that any amount of warp can be given off by revolving the yarn beam B, by means of the worm *m*, in one direction, while it will be taken up; or, the reverse will be produced by the opposite motion of the worm *m*; and further, that the position of the shaft G, will vary or vibrate according as the warp is taken up, or given off by the yarn beam B. Suppose, for example, the warp to be wound up to a given point, by means of the small handle *o*, the shaft G, will assume a certain position, and the amount of tension to which the warp is subjected will depend upon the amount of counter weight H, which has a constant tendency to elevate the shaft G, as best shown at Figs. 158 and 159. Under these circumstances, as soon

Fig. 159.

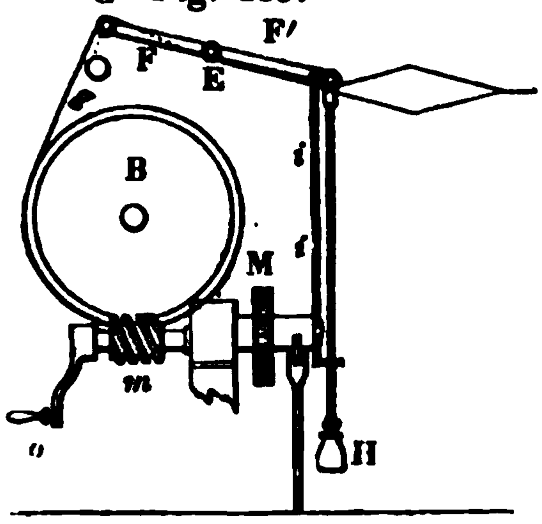
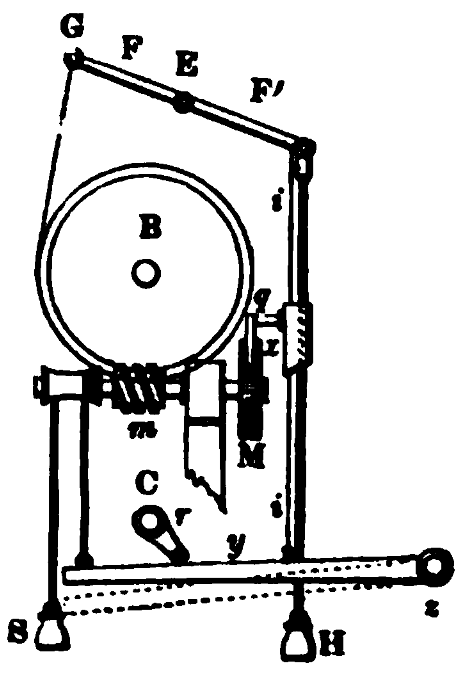


Fig. 160.



as the loom is put into action and the regular vibration of the lay proceeds, the cloth which is produced will be taken up on the cloth roller D, and consequently the warp which passes

over the shaft G, will have a tendency to depress that shaft, although the tension will not materially vary, on account of the counter weight H, always remaining the same. But as soon as the take-up of the cloth roller has proceeded so far as to depress the shaft G, to the position indicated by the letter g, (Fig. 159) the rod i, i, elevates the lever K, which is connected to the catch or dog q (Fig. 157,) and thereby gathers a tooth in the ratchet M, which, on the return of the lay, is carried forward by the counter weight N, and actuates the yarn beam B, which gives off the amount of warp required. This train of movement is shown separate in Fig. 159; by which, together with the foregoing description, it will be obvious that the regular take-up of the cloth on the roller D, as it is produced, is provided for by a commensurate giving off of warp from the beam B, caused by the depression or varied position of the shaft G, as already explained. In weaving cloth of a fine quality, the arrangement represented at Fig. 160 will act rather more uniformly than that already described. In this figure, the arrangement of parts does not vary from that already stated, excepting that in the place of the weight N, and vibrating lever K, the catch or dog q, is placed on a stationary fulcrum x, and the rod i, i, is carried downwards and attached by a small spring to the lever y, which moves freely on a fixed fulcrum at z. This lever y, is placed under the tappet shaft C, and when a sufficient quantity of yarn is given off from the beam B, the small wiper r, does not interfere with it, but as soon as the rod G, is depressed by the tightening of the warp, as already described, the lever y, is raised and comes in contact with the wiper r, which immediately depresses it, and rotates the ratchet wheel M, by means of the band and tightening weight S, with which it is connected; this band being passed round the small drum or barrel placed on the same shaft that supports the ratchet M.

The shafts G, and E, should be well polished, so that the warp yarn, in passing under and over them, may not be chafed.

This contrivance, for giving off warp yarn and actuating the taking-up of the cloth, does not possess any particular feature of novelty which we can recommend, in a practical point of view, to the cotton manufacturer. For the manufacture of silk goods the shafts G, and E, might be used with advantage, provided that another shaft, similar to that marked G, was inserted at the point of the arm F′, cutting away the connecting rod i i, and all the other parts of the apparatus shown in the Figs. These three shafts, acting on the warp threads, would keep them

equally tight on both sides of the shed; which will be obvious after a word of explanation.

Suppose, for example, that the warp, in coming from the beam B, is passed over the shaft G, under the shaft E, and over that fixed at the point F′, and from thence into the headles; it is evident, that while the shed is forming, the rollers at the extremities of the arms F, and F′, will be raised or depressed in proportion to the strain caused by the shedding of the warp, the vibratory action always compensating by yielding at the point where the greatest strain is caused, that is to say, when the shed is full open, as shown in the Figs., and acting as a distender on the warp in proportion as the shed closes after the passage of the shuttle (taking up the slack.) Looms mounted with this contrivance, in connection with the vibrating reed take-up motion, shown at Fig. 169, would, we have no doubt, be found advantageous in weaving delicate yarns. (See Figs. 219 and 220.)

> "Nature in her productions slow, aspires
> By just degrees to reach perfection's height:
> So mimic art works leisurely, till time
> Improve the price, or wise experience give
> The proper finishing."

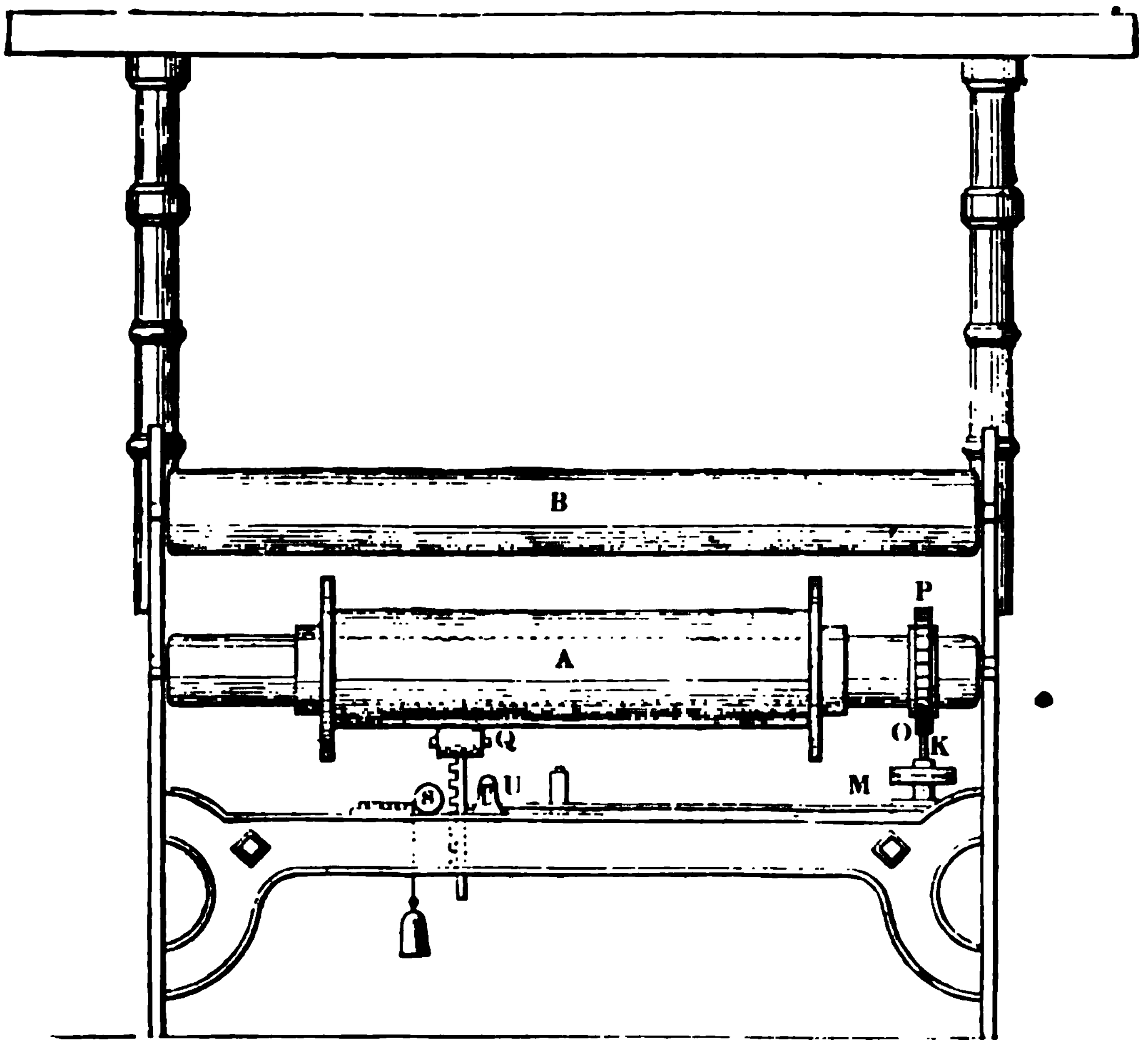
Manufacturers have, as is well known, experienced great inconvenience in regulating the relative motions of the yarn and cloth rollers in the loom; and although many attempts have been made to remedy this evil, yet for the most part they have totally failed in accomplishing the desired object. The few that have partially succeeded, have been attended with so much expense as to prevent their coming into general use. The improvement now offered is such that it can be added to power looms of all descriptions at a very trifling expense, and we think will completely remedy the evil, at least so far as cotton stuffs are concerned. If found available we shall be glad, as it first originated with us in the year 1835, but a patent for which was granted to Mr. Edwin Bottomley, of South Crossland, in the parish of Almonbury, county of York, clothier, bearing date Sept. 30th, 1838, prior to which date we tested the invention for over two years at M. Philippe's machine shop, 19 Rue Chateau Landon, Paris, France.

In these drawings the same letters of reference indicate the same parts.

Fig. 161, represents a back elevation of a loom of the ordinary construction, to which the improvements are applied; Fig. 162, is

a side view of the same; Fig. 163, is a plan of the improved mechanism, and Fig. 164, a side view of it.

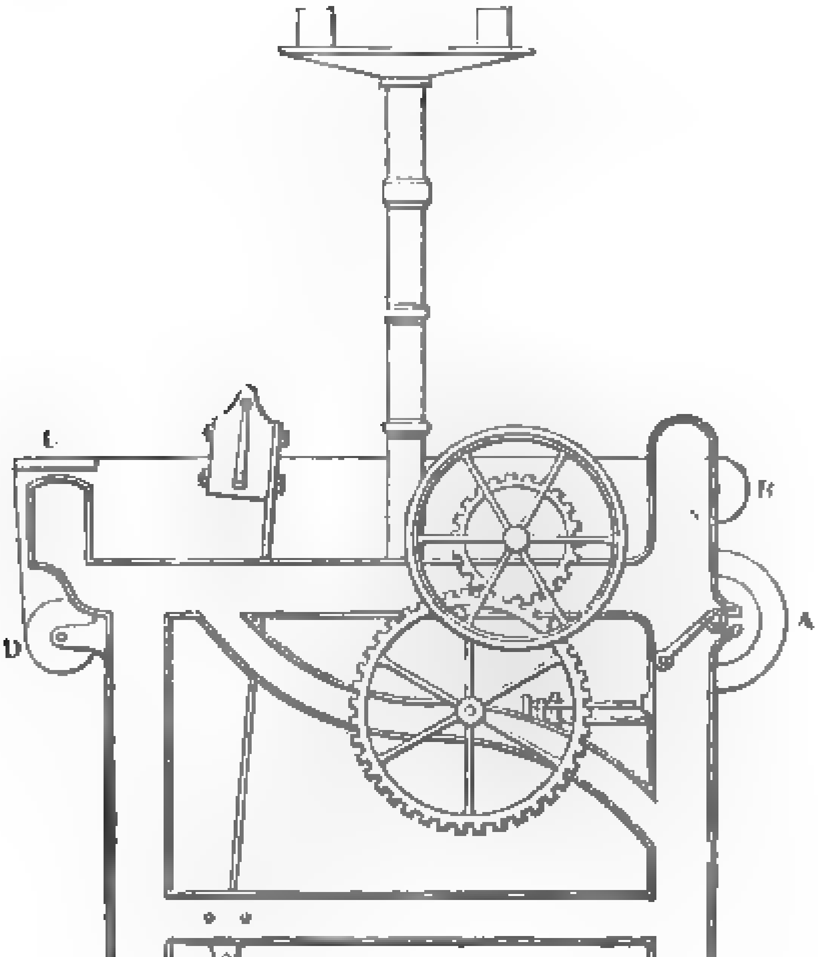
Fig. 161.



The yarn beam A, is placed in the usual position, and contains the warp which passes over the roller B: after the warp is woven it passes over the breast beam C (Fig. 162) and is taken upon the cloth roller D. On the shaft E (Fig. 163) is placed a cylindrical eccentric F F, which imparts alternating movement to the forked piece G G. This forked piece G G, embraces the eccentric F F; and its arm or connecting bar is provided with a slot through which one of the arms of the bell-crank lever H H, passes (Fig. 163.) To the opposite arm of the bell-crank lever H H, is attached the connecting rod I; and this rod communicates motion to the lever J, which vibrates on the centre of the upright shaft K. The lever J, is furnished with a small stud or pin in which the pinion L, and also the ratchet wheel M, revolve; these wheels, being connected with each other, the small pinion L, is geared into the spur-wheel N (Fig. 163,) fixed to the shaft K (see Fig. 161.) To this shaft is also keyed the worm O, which actuates the worm-wheel P, and consequently the yarn beam A, on the axis of which the worm-wheel P,

is placed. Thus the rotation of the shaft E, imparts to the yarn beam a giving off motion, in a ratio corresponding with the number of vibrations of the lay; but it is obvious that a greater length of warp yarn would be given off the larger diameter of a full beam than where the diameter is reduced; hence it is required that the yarn beam increase its speed of rotation as the diameter becomes less, thereby insuring an equal quantity of warp given off at each beat of the reed against the cloth, whatever may be the diameter of the yarn beam.

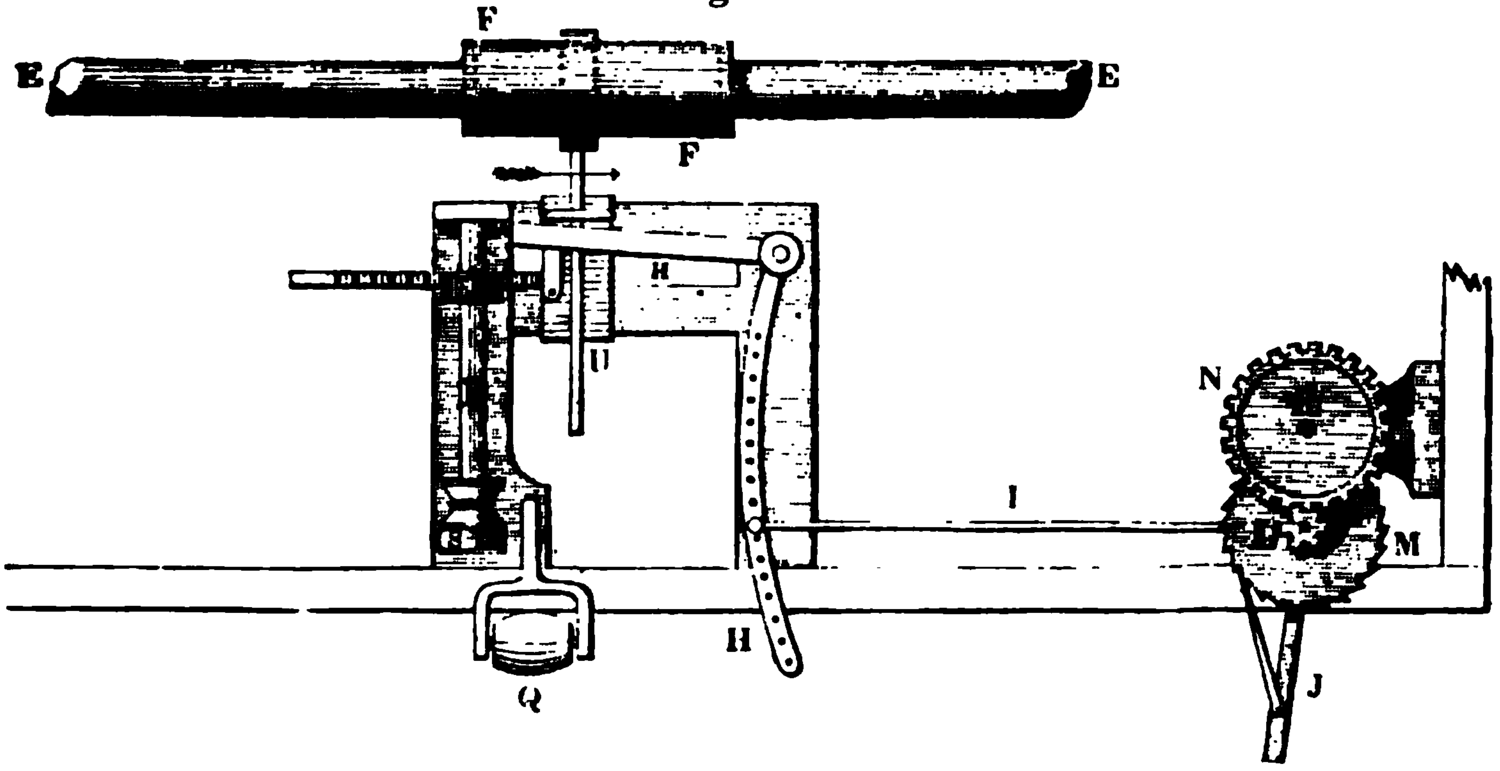
Fig. 162.



We shall now proceed to describe how the required increase of speed to the yarn beam A, is effected. A small roller of wood or other suitable material Q, is supported, as shown in Fig. 161, by a sliding-piece U, moving freely in a slot in the frame-work of the loom, as shown in Figs. 161, 163 and 164; fixed to this support, is a rack continuing downwards and working into the pinion S, (Fig. 163) at the opposite extremity of which is another pinion T, (Fig. 161) working into the rack attached to the sliding carriage U. On the shaft R, (Figs. 162, 163 and 164) is a small pulley provided with a cord, to which is suspended a weight, for the purpose of

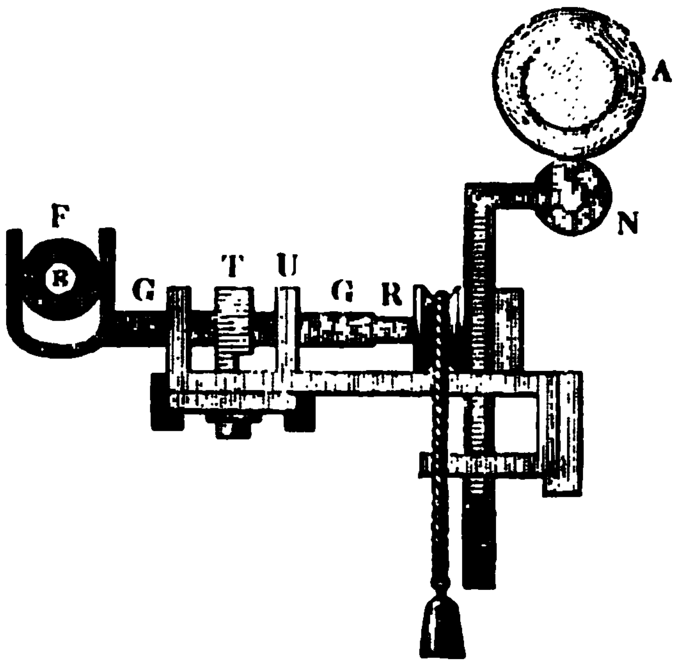
keeping the roller Q, constantly pressing against the under side of the yarn, as shown in Fig. 161. By this contrivance, the reduction in the diameter of the warp on the yarn beam, as it is consumed in the weaving process, allows the roller Q, to rise, which conveys a traverse motion to the carriage U, in the direction of the

Fig. 163.



arrow, Fig. 163, and brings it nearer to the centre or fulcrum of the bell-crank lever H H, which has the effect of increasing the range or space through which the opposite arm of the lever vibrates, and thus producing an increased vibration in the lever J, by means of the connecting rod I, which by means of the dog or catch V, (Fig. 163) gathers more teeth in the ratchet wheel M, and consequently increases the speed of revolution of the yarn beam A, thereby compensating for the decreased diameter, as already explained, and thus an equal and uniform delivery is effected during the whole of the weaving process, without reference to the length of the warp that may be rolled on the yarn beam. On the arm of the bell-

Fig. 164.



crank lever H H, to which the connecting rod I, is attached, will be seen a series of small holes, and it is by connecting the rod I, to any one of these holes, either nearer or further from the fulcrum of the bell-crank lever H H, that the amount of vibration of the take-up lever J, is determined, and either greater or less amount of warp yarn is delivered from the beam after each vibration of the lay, according to the nature of the fabric to be woven.

From the foregoing explanation, any practical power loom weaver will have no difficulty in comprehending the improvement.

Figs. 165, 166, 167 and 168, represent an improved power loom for weaving light textures, invented by Amassa Stone, an extremely ingenious mechanic of Johnstone, Rhode Island. By means of this improvement, whenever, from the accidental breaking or non-delivery of the weft, the striking up of the reed meets with little or no resistance, the delivery of the warp, and also the taking-up of the cloth, is suspended, although the general evolutions of the loom continue.

Fig. 165.

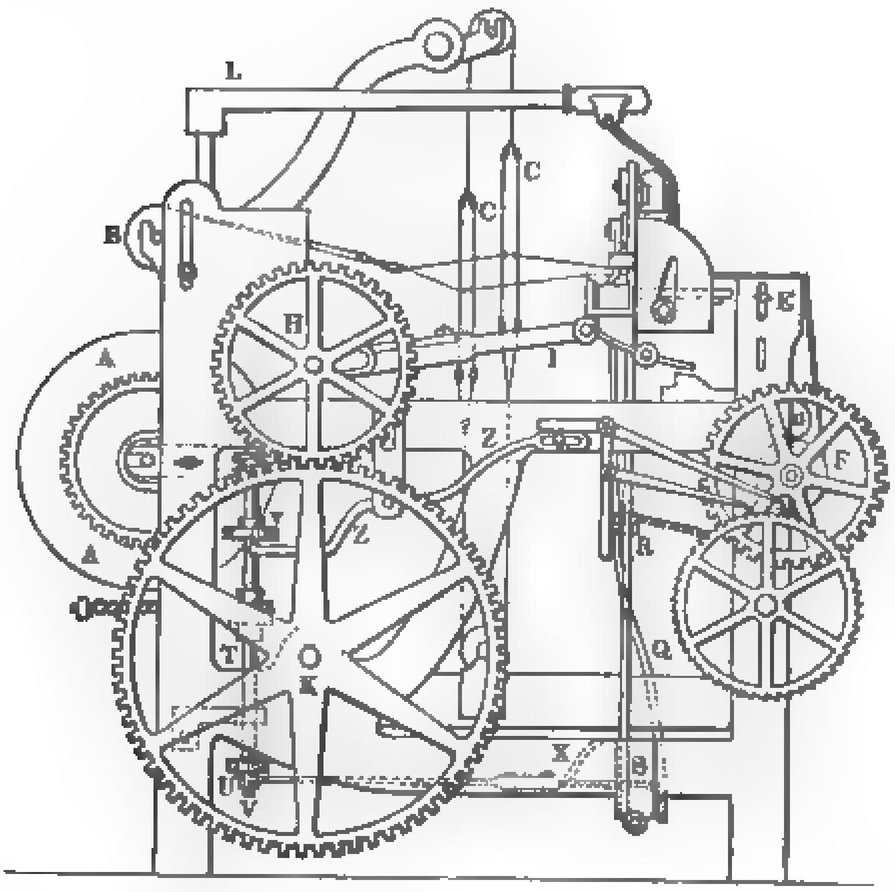


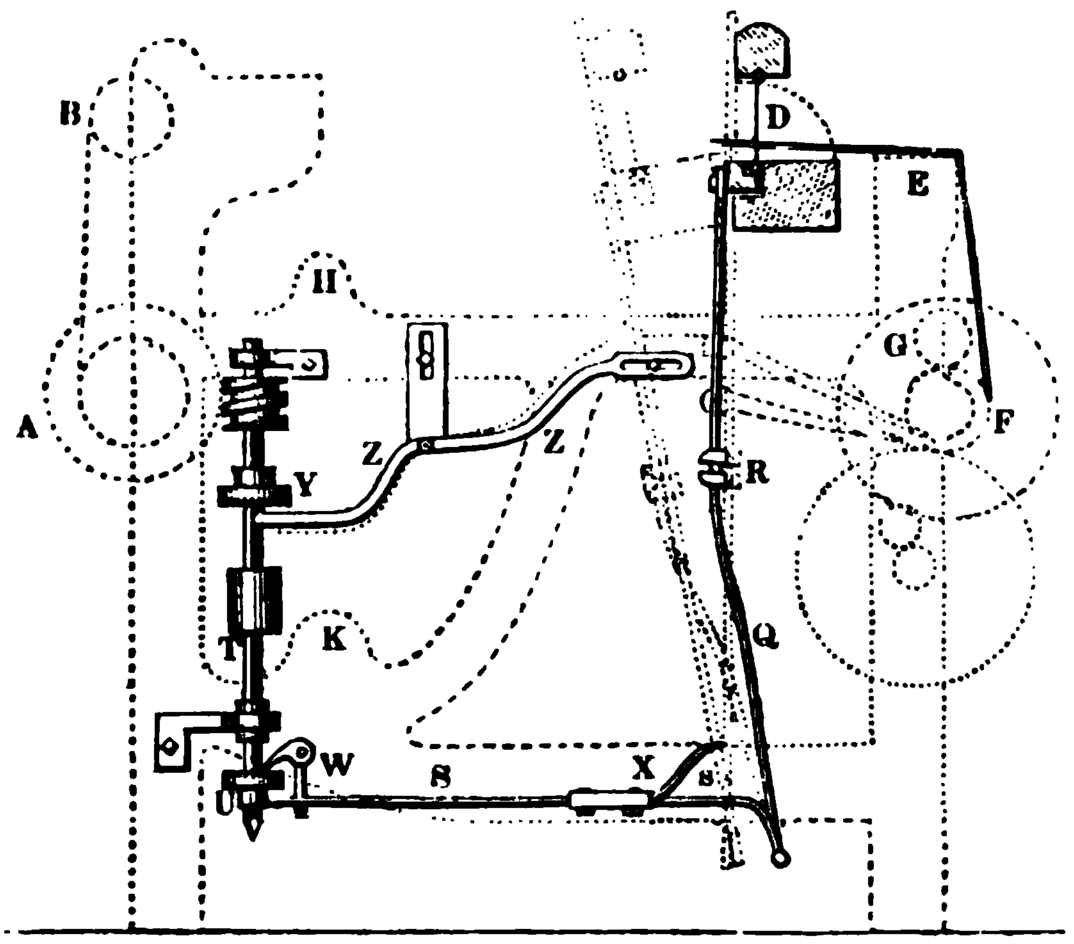
Fig. 165, is a side view of the loom, with the novel parts attached, and in working order; Fig. 166, is a profile representation of the same, showing particularly the novel parts; Fig. 167, is a vertical section, taken through the loom at right angles to Fig. 165,

in the line looking toward the cloth beam; Fig. 168, is a vertical section, also at right angles to Fig. 165, in the line looking in the opposite direction, that is, toward the warp beam; and No. 30, Fig. 167, is a horizontal view of a portion of the lay of the loom, taken at that end where the improved parts are connected; the respective letters of reference pointing out the same parts in all the figures.

The yarn beam A, is mounted on the side framing of the loom in the usual way. From this beam the warp threads pass over a whip roller B, above, and thence through the headles C, C, and reed D, in the ordinary way. The reed is mounted in the lay in a frame, which is capable of vibrating on pivots or centres, for the purpose of allowing the reed to fall back when it strikes forcibly against the weft thread in beating up. The cloth produced by the intervention of the warp and weft threads in the front of the reed, passes over the breast beam E, to the cloth roller F, and is wound upon a loose roller G, by the friction of their surfaces.

The crank or driving shaft H, by which the working parts of the loom are driven, is connected by the crank rods I I, to the back part of the lay; and hence, as the crank shaft rotates, the latter is made to vibrate in the usual way; and by the ordinary connexion of toothed wheels, the tappet shaft K, is also driven, which works the headles C C, that open the sheds of the warp, and also the picker staves L L, that drive the shuttle to and fro.

Fig. 166.

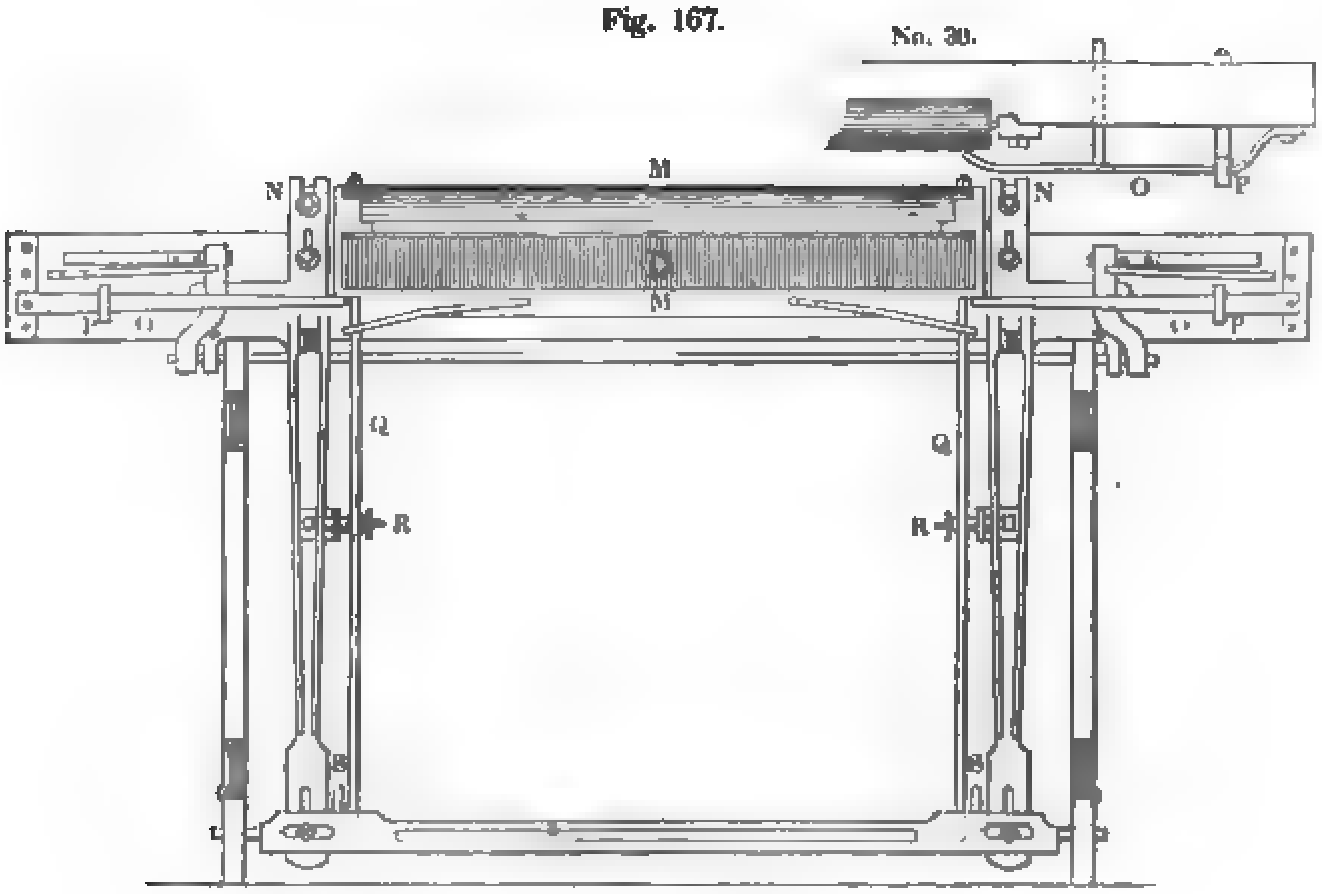


In the representation of the back of the lay at Fig. 167, it will be perceived that the reed D, is fixed in a frame M M; which frame is mounted in the lay, and held by pivots on studs N N, bolted to the upper parts of the swords of the lay. Upon these studs or pivots N, the reed, with its frame, is enabled to swing backward, but it is confined in its situation by powerful springs O O, secured to the back of the lay, the ends of these springs pressing against the lower rail of the reed frame. The tension of these springs may be tempered by the adjustable staples and screws P P.

These parts of the loom are described for the purpose of leading to, and more readily illustrating the design and operation of the present improvement.

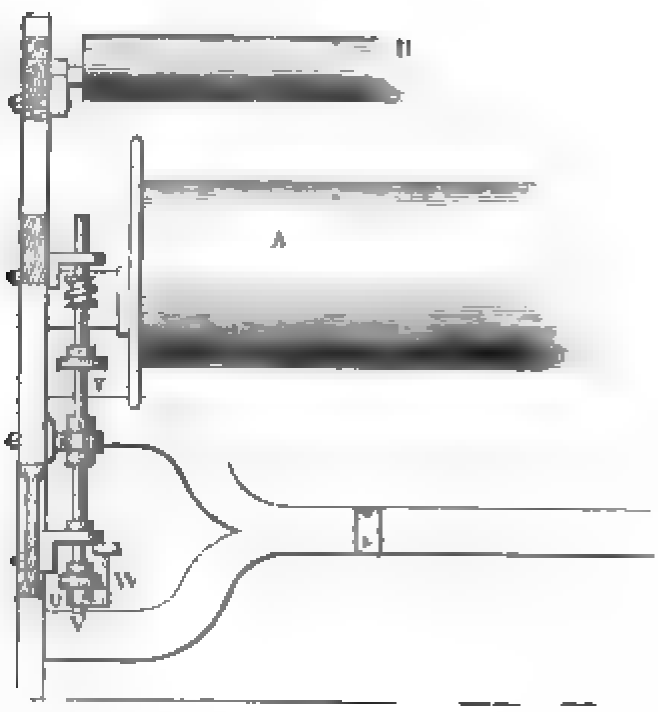
A perpendicular lever Q, is attached to the side of one of the swords of the lay by means of a fulcrum stud R, projecting from a bracket bolted to the sword. The upper end of this lever bears against the bottom rail of the back of the reed frame M, and is held there by a slight spring (see Fig. 167.) The lower part of this frame is attached by an axle joint to a horizontal rod S. That end of the rod S, to which the lever Q, is connected, is bent downward, as shown in Fig. 166, for the purpose of enabling the rod to pass over the rocker at bottom of the sword, which the lay vibrates upon. The joint connecting the end of the lever Q, and rod S, must be brought as nearly in coincidence with the axle of the lay as may be found practicable.

Fig. 167.



At the back part of the loom there is a perpendicular shaft T, supported in brackets bolted to the side frame or standard. Upon the upper part of this shaft is fixed an endless screw or worm taking into the teeth of a wheel on the yarn beam; by the rotation of which worm the beam is turned, and made to deliver the warp. A ratchet wheel U, is made fast by a bolt to the perpendicular shaft T, near its lower end; and below this a cylindrical piece or collar V, is loosely fitted upon the shaft, and held up by a pin.

Fig 168.



From this side of the collar V, a small arm extends, carrying an upright stud, which passes through an eye at the back end of the horizontal rod S, for the purpose of forming a jointed support to that end of the rod. At a short distance from this joint, a standard W, is fixed into the horizontal rod, carrying a click or tooth, the point of which drops into the teeth of the ratchet wheel. This tooth is the driver that gives rotary movement to the ratchet wheel U, and shaft T.

A bent arm X, is affixed by bolts to the horizontal rod S, the elevated end of which arm being struck by the sword when the lay falls back, gives a sliding movement to the rod S, and thereby causes the click W, to drive the ratchet wheel U.

Below the endless screw on the perpendicular shaft T, another ratchet wheel Y, is fixed, corresponding in the number of its teeth with the ratchet wheel U. This ratchet wheel acts upon a tooth at the end of the shorter arm of a bent lever Z, Z, suspended on a pivot or stud in a bracket attached to the side frame. At

the reverse end, that is, near the extremity of the longer arm of this bent lever Z, a tappet pin is fixed, for the purpose of raising the arm of the ordinary taking up lever, which works the click or driver of the ratchet connected with the ordinary train of toothed gear, for taking up or winding the cloth upon the beam in front, as usual.

After every flight of the shuttle through the open shed or warp, the lay advances for the purpose of causing the reed to beat up the weft thread; but as it is mounted in a vibrating frame M, the force with which it strikes against the cloth causes the lower rail of the reed frame to recede or swing back from the lay a short distance, as shown in the section Fig. 166.

As the upper end of the perpendicular lever Q, bears against the lower rail of the reed frame whenever the reed frame recedes, as above described, that end of the lever is necessarily forced back, and the under end consequently moved forward, bringing with it the horizontal rod S. This movement of the rod S, causes the end of the bent arm X, to be brought close against the vibrating sword of the lay, and also draws back the click W, over one tooth in the ratchet wheel U. On the return of the lay into the inclined position, as shown by dots in Fig. 166, the sword will strike against the end of the bent arm X, and slide the horizontal rod S, back again, which will cause the click W, to drive the ratchet wheel U, one tooth, and thereby turn the shaft T, and its endless screw, by means of which the yarn beam is drawn round, and the warp given out.

But in the event of the weft thread having broken, there will be no delivery from the shuttle, and consequently a want of filling to the cloth; the reed, therefore, in beating up, will not meet with that resistance which it did when the filling of the weft thread was perfect. In the beating up of the lay, therefore, the reed frame will not now be driven back as before, nor the lever Q, be sufficiently acted upon to cause it to slide the horizontal rod S, through the same distance: consequently, the click W, will not be drawn over another tooth of the ratchet wheel U; and the shaft T, being thus allowed to remain in a quiescent state, the warp will no longer be given out from the yarn beam.

The rotary movement given to the shaft T, in the way described, carries round the ratchet wheel Y; and the teeth of this ratchet wheel acting upon the tooth at the end of the shorter arm of the bent lever Z, causes that end of the bent lever to be depressed every time that a tooth of the wheel Y, passes over the tooth of the lever, as shown by dots in Fig. 166.

By these means, the reverse end or longer arm of the lever is

raised, which causes the tappet pin fixed near its extremity to lift the take-up lever, which operates upon the ordinary gearing for winding up the cloth on the roller as usual. But when the rotary movement of the perpendicular shaft T, is suspended, owing to the breaking of the weft thread, as before stated, then the taking up of the cloth ceases, as well as the delivery of the warp, although the loom continue in action.

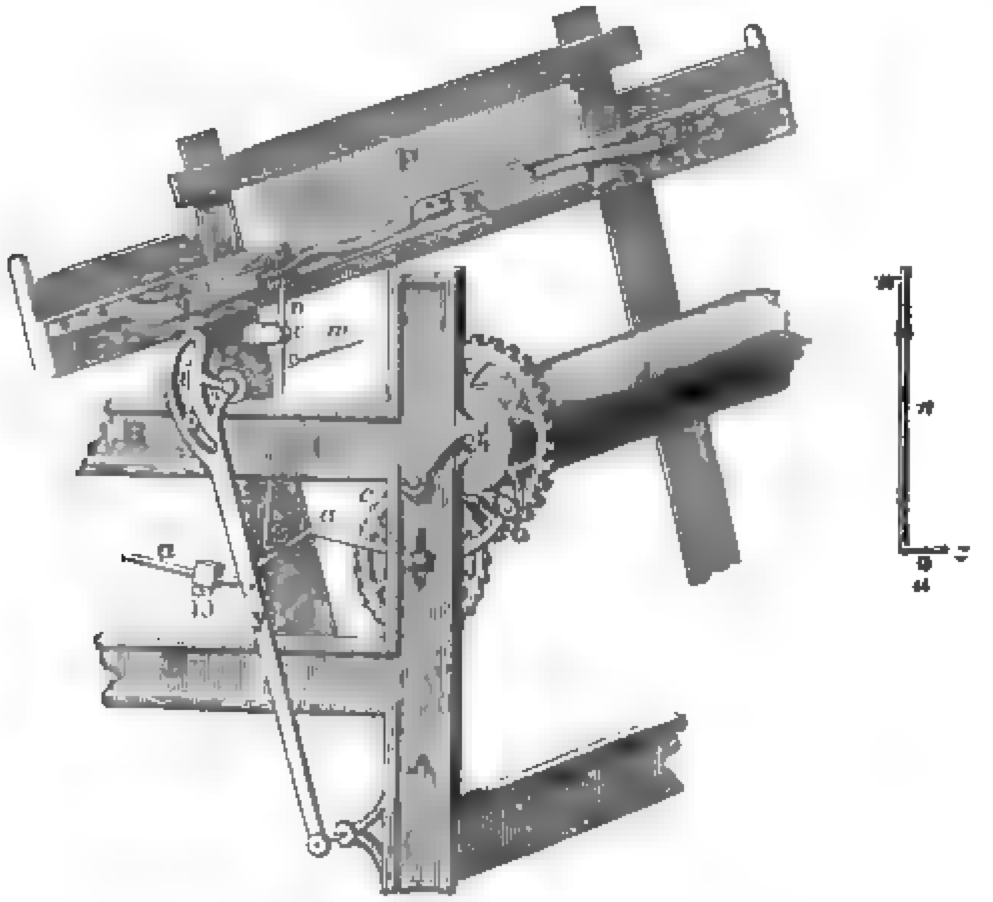
To a superficial observer, this contrivance of Mr. Stone's might appear to be the very acme of perfection ; yet, it possesses many defects, in a practical point of view. In the first place, it is of too complex a character: indeed, all that it accomplishes, can be effected with one-fifth of the machinery which it contains. Mr. S's. loom is not capable of producing thin goods with any degree of regularity ; and this will be evident when it is remembered, that it is by the accumulating pressure of the cloth against the reed that motion is communicated to the yarn beam. It is clear, therefore, that for light muslins, or delicate silk textures, where only from 10 to 25 threads of weft per inch are required, this contrivance would not answer at all; unless Mr. S. hung his reed upon a *wisp*, and employed, *in conjunction*, a native of the Emerald Isle, to assist, by coaxing the warp from off the yarn beam as fast as required. The cloth, instead of being taken up regularly *as the weaving proceeds*, is wound up by *fits and starts* ; for it is not until a number of threads of weft have been added to the face of the cloth, *equal to the length of one of the teeth in the ratchet wheel* U, on the end of the perpendicular shaft T, that the click or driver W, is allowed to fall into a new tooth ; and after this has taken place, it will keep jiggling or dancing there, until another ridge of cloth is *piled up against the reed*, when the point of the click W, will again hop over a tooth, as before.

In order to make this loom weave thin goods perfectly regular, it would be absolutely necessary to have the teeth of the ratchet wheel U, as fine as the diameter of the weft thread to be used ; but we question whether teeth of this fineness would not be more than a match for the eye-sight of any manufacturer in the United States. For textures having from 35 to 80 threads of weft per inch, however, Mr. Stone's loom will be found an acquisition.

Fig. 169, represents part of the frame of a loom, with the common ratchet take-up motion attached thereto, as well as an improved method of governing it, receiving motion from a vibrating reed, which is arranged in a frame, precisely the same as that shown in Figs. 165, 166, 167 and 168. The improvement now to be de-

scribed, although exceedingly simple, is capable of effecting all that Mr. Stone's apparatus can accomplish.*

Fig 169



A B B C, is the frame of the loom; *w*, *w*, the lay; P, the reed; *g*, *g*, two springs, for the purpose of keeping the under part of the reed frame K, pressed up. The springs *g*, *g*, are screwed by two screws at each end, as will be perceived by the black dots at the points *w*, *w*, and are governed, in regard to their pressure against the rail K, by means of two clasp bolts passing through the lay; which clasp bolts may be seen close to the letters *g*, *g*; these bolts have regulating nuts, one at the back and the other at the front of the lay, for the purpose of setting the bolts to any required position, according to the degree of pressure intended to be communicated from the springs *g*, *g*, to the rail K, of the reed frame. In the operation of the loom, the rail K, is pressed back by the reed P, at each vibration of the lay, a distance equal to the diameter of the weft thread. *n*, *n*, is a lever having its fulcrum at *o*, the upper end of which lever is kept pressed against the rail K, at the point X, by means of the spring *v*; and this spring is made fast to the rail K,

* The connexion between the reed and the yarn beam is not absolutely necessary; because, a uniformity of tension may be communicated to the warp from the cloth roller.

by two screws, as indicated by the black dots.* At the lower end of the lever *n*, *n*, is a turned-up part *z*, which touches the inclined part of the arm *a*, *a*, *a*: this arm has its axis at V, and carries at its end a click or driver *e*, for giving motion to the ratchet wheel *c*, which wheel has a pinion made fast to it, and taking into the spur wheel on the end of the cloth roller *d*: the ratchet wheel *c*, is prevented from recoiling by a suitable catch fixed inside the frame, its point working into the teeth of the ratchet a little to the right of the letter *c*.

The vibrating motion of the lay is effected through the agency of a stud-pin carrying a small roller which works in the sweep *i*: this stud-pin is connected to an arm on the end of the driving shaft *m*.† When the loom is put in operation, the reed P, is forced back by the weft in the act of beating up; and as the weft acts on the lever *n*, *n*, and makes its lower end to strike against the arm *a*, *a*, *a*, so as to put the cloth roller *d*, in motion, it thus winds on the texture as it is woven; but if the reed beats up without the weft, it will not in that case be forced back, as there would not be any addition to the cloth, by the crossing of the weft, to that which had been previously beaten up; the reed, therefore, would not be forced back by the subsequent motion of the loom, and consequently the lever *n*, *n*, would not strike against the inclined face of the arm *a*, *a*, *a*, and, of course, the taking-up apparatus would not be set in motion.

The inclined arm *a*, *a*, *a*, has a small governing weight 10, at its end, which serves to balance it and keep the click or driver *e*, against the tooth in the ratchet wheel *c*: but this weight 10, is not sufficiently heavy to cause the ratchet wheel *c*, to revolve. The sword of the lay carries a small roller or pulley fixed on a stud-pin, as shown a little above the letter *y*; this roller serves to elevate the inclined arm *a*, *a*, *a*, after it has been depressed by the action of the turned-up end of the lever *n*, *n*, upon it, in the manner already explained; so that in the backward motion of the lay, the roller will raise the arm *a*, *a*, *a*, and will thereby cause the click *e*, to fall back into a new tooth in the ratchet wheel *c*; in which tooth it will remain, until the lever *n*, *n*, has received sufficient motion from the point X, to cause the other extremity to depress the arm *a*, *a*, *a*, and

* A patent for this invention (Fig. 169) was granted to Oliver C. Burr, an ingenious mechanic, of Milbury, Mass., bearing date July 17, 1835.

† The figure being drawn in perspective, only one of the swords of the lay, with its sweep *i*, can be seen; but the opposite side of the lay, of course, has a similar sword with a sweep *i*: no difficulty can be experienced on this head.

force the ratchet *c*, forward a distance equal to that which the catch *e*, had fallen back in the previous working of the loom.

Before commencing the operation of weaving, the lever *n*, *n*, must be so set in relation to the inclined arm *a*, *a*, *a*, that when the reed is brought full up to the face of the cloth, the turned-up end of the lever *n*, *n*, will nearly touch the inclined face of the arm *a*, *a*, *a*; and when the lay is thrown full back, the roller will not touch the under side of the arm, because the arm had not been previously depressed by the lever *n*, *n*. In this position, therefore, the loom may continue to operate for ever without any motion being communicated to the ratchet wheel *c*, unless weft be added to the face of the cloth. It will be perceived, that a very slight addition of weft to the cloth (say two or three threads) will communicate extensive motion to the arm *a*, *a*, *a*; and this is caused by the greater leverage of the lower end of the lever *n*, *n*. For looms of the working size, the length of the lever *n*, *n*, from the axis *o*, to the rail K, is 5 inches, and from the axis *o*, to the other extremity, or turned-up end, 17 inches; but these relative lengths may be varied to suit the different heights of looms. It is very evident, therefore, that this improvement or contrivance, is not only simpler, but superior to Stone's motion, and possesses the advantage over it, of taking up the cloth with greater regularity; because, the action of the lever *n*, *n*, is direct on the arm *a*, *a*, *a*, at each pick of weft; *three threads of weft at most being sufficient to communicate action to the arm a, a, a*; it is, however, not perfect, on this very account, being liable, to a certain extent, to the same defect experienced in Stone's mechanism, namely, the piling of the cloth against the reed before any motion at all can be communicated. For shirtings and calicoes, of from 30 to 80 or 90 threads of weft per inch, this motion is, perhaps, the best in existence at the present day; and the expense of fitting it to a loom is only a few shillings.

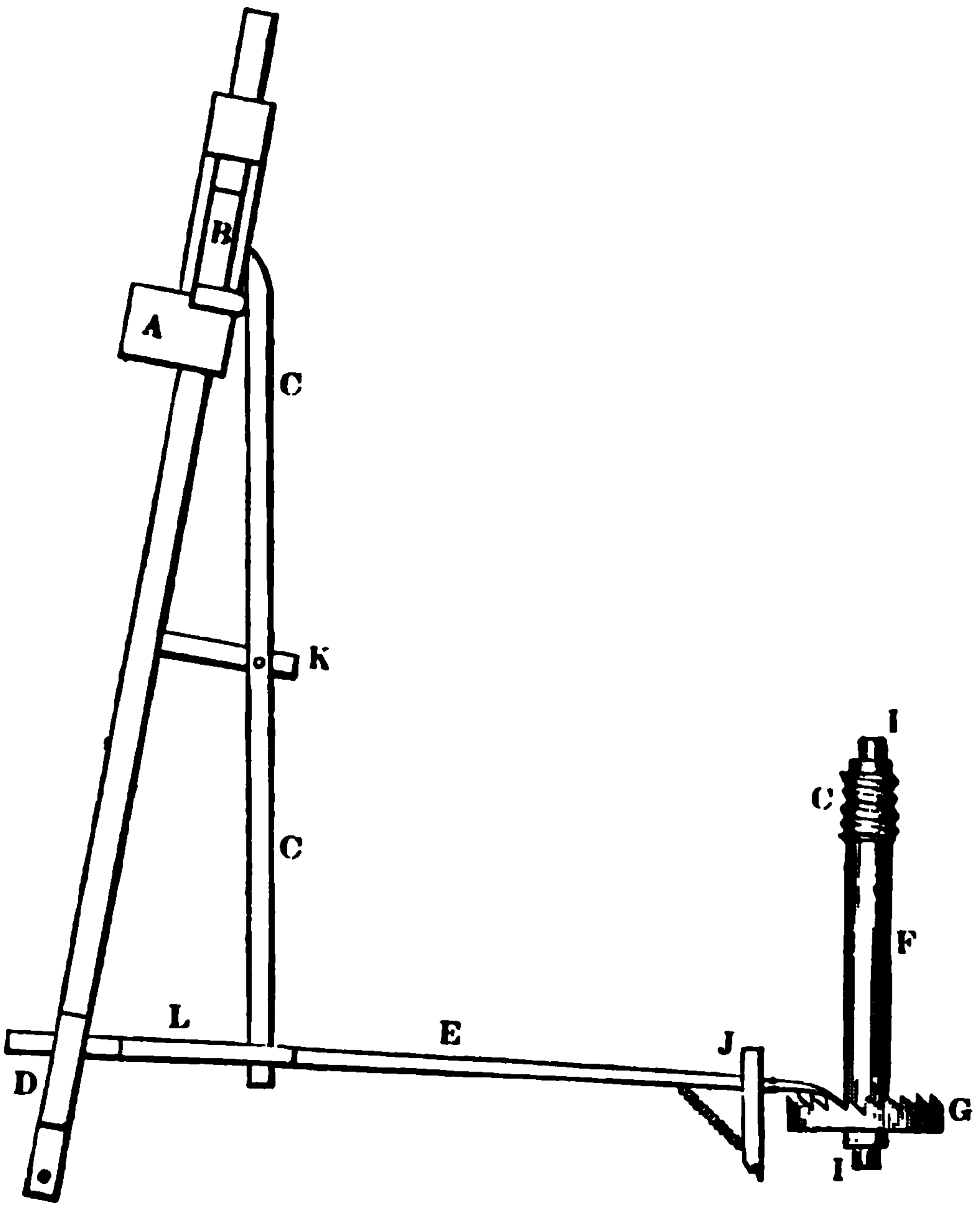
"The invention is mine," said a would-be inventor;
"You lie," said a second, "I own 't, and no other;"
A third cried, "'tis mine!" with a voice loud as Stentor;
And a fourth *swore* 'twas his; while a fifth was its father.

Figs. 170 and 171, exhibit another method of regulating the movement of the yarn beam, and of taking up the cloth, so as to produce textures of uniform thickness throughout: but this contrivance contains the same defects as those pointed out in Mr. Stone's

loom ; upon which loom it is, indeed, a direct infringement, although it possesses the merit of being somewhat simpler.*

A, is the lay ; B, the spring reed ; C, a lever, extending down nearly as low as the bottom of the lay sword ; D, the part of the lay in which the bar E, slides ; F, a perpendicular shaft, having a ratchet wheel G, at its lower end, and an endless screw or worm H, on its upper end which operates, by gearing, to give the requisite motion to the yarn beam as in Stone's loom ; I I, steps of the perpendicular shaft ; and J, a guide piece, having a notch or mortise in it to receive and guide the bar E, which acts upon the ratchet wheel G.

Fig. 170.



The following is the manner in which the bar E, receives its motion from the spring reed B :—

When the lay advances and brings the reed into contact with the

* This *alteration* of Stone's loom, notwithstanding its similarity to the original, was made the subject of a patent by one Welcome A. Potter, of Cranston, Rhode Island, Nov. 23, 1837 ; which circumstance goes far to prove what we have time after time stated, that there is in reality no more protection for the ingenious man in the United States of America than in Great Britain.

cloth, the springing of the reed throws the top of the lever C, back, being actuated by the resistance of the face of the cloth against the reed, and as this lever works upon a fulcrum K, in the lay, and its lower end passes into a mortise or slot at L, in the bar E, and bearing against the fore end of this slot, draws the rod forward by the back motion of its upper end, and the back end of the bar E, then catches upon a tooth of the ratchet wheel G, to which wheel it will give motion when the lay is thrown back: this force is effected by the sword of the lay coming into contact with a shoulder at M, thus forcing the bar E, back and turning the ratchet wheel G, the shaft F, then moving the yarn beam by means of the worm or screw H.

The foregoing description represents the bar E, as receiving its motion through the agency of the spring reed: but Mr. Potter says that he sometimes communicates it through that of the spring whip roll, as shown in Fig. 171.

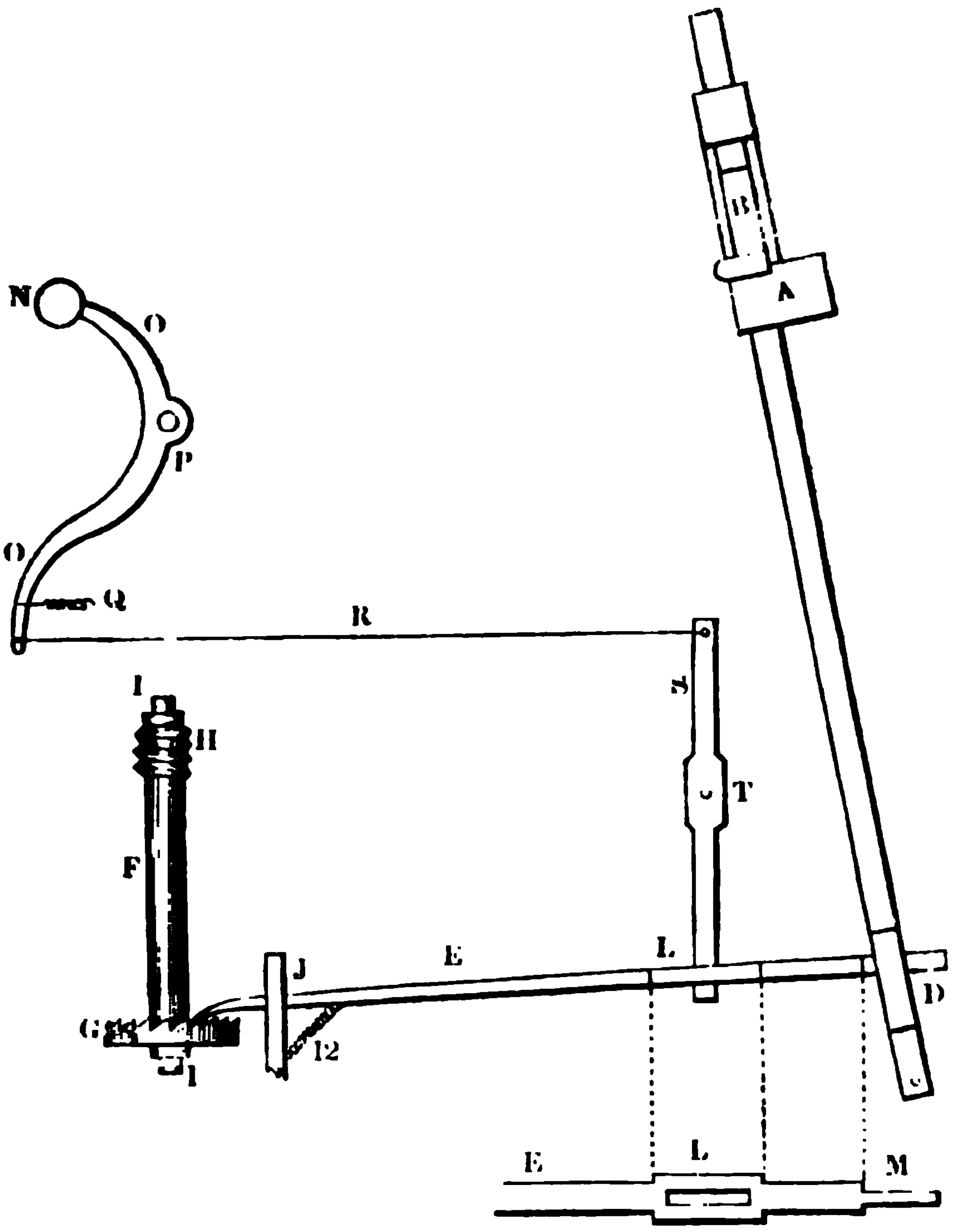
The whip roll N, is supported by a bent arm O, there being a similar one at its other end; the bent arm O, works on a fulcrum P, made fast to the frame of the loom, said bent arm extending to about an equal distance from the fulcrum at each end. A spring Q, acts upon the lower end of the bent arm, for the purpose of holding it in its proper position when not acted upon by any other force.

When the lay moves forward, and the reed presses forcibly on the cloth, this has the effect of drawing the whip roll N, forward, and causing the lower end of the bent arm O, to recede: from this lower end, a rod or wire R, extends to a lever S, working on a fulcrum T, on the frame of the loom, its lower end passing into a mortise or slot in the bar E; and this lever is operated upon in a manner similar to that of the lever C, already described: in both Figs. the mortise L, must be long enough to give play to the lever E, without moving the lever C, (Fig. 170) or the lever S, (Fig. 171.)*

On referring to Mr. Stone's machine, Figs. 165, 166, 167 and 168, and comparing it with Mr. Potter's modification, shown in Figs. 170 and 171, the real character of the infringement will be manifest. In the first place, Mr. Stone's invention consists, in the

* The whip roll N, in connexion with the lever O, for the purpose herein explained, is not the invention of Mr. Potter, Mr. Louis Schwabe and other manufacturers, of Manchester, having used it several years before the date of his patent; and these gentlemen, *no doubt*, can tell Mr. Potter to whom the invention truly belongs.

Fig. 171.



application of the lever Q, in connexion with the rod S, having the bent arm X made fast to it, the click W, ratchet wheels U, and Y, vertical shaft T, and the worm working into the spur wheel A A, on the end of the yarn beam (see Figs. 165 and 166 ;) and these parts, receiving motion from the vibrating reed D, govern the giving out of the warp, as well as the taking-up of the cloth, the one depending upon the other. This feature forms the subject of Mr. Stone's patent ; and, we think, with justice too ; for the contrivance is really very ingenious, and does its inventor credit, notwithstanding its inapplicability to *some kinds of textures*, as has been already stated.

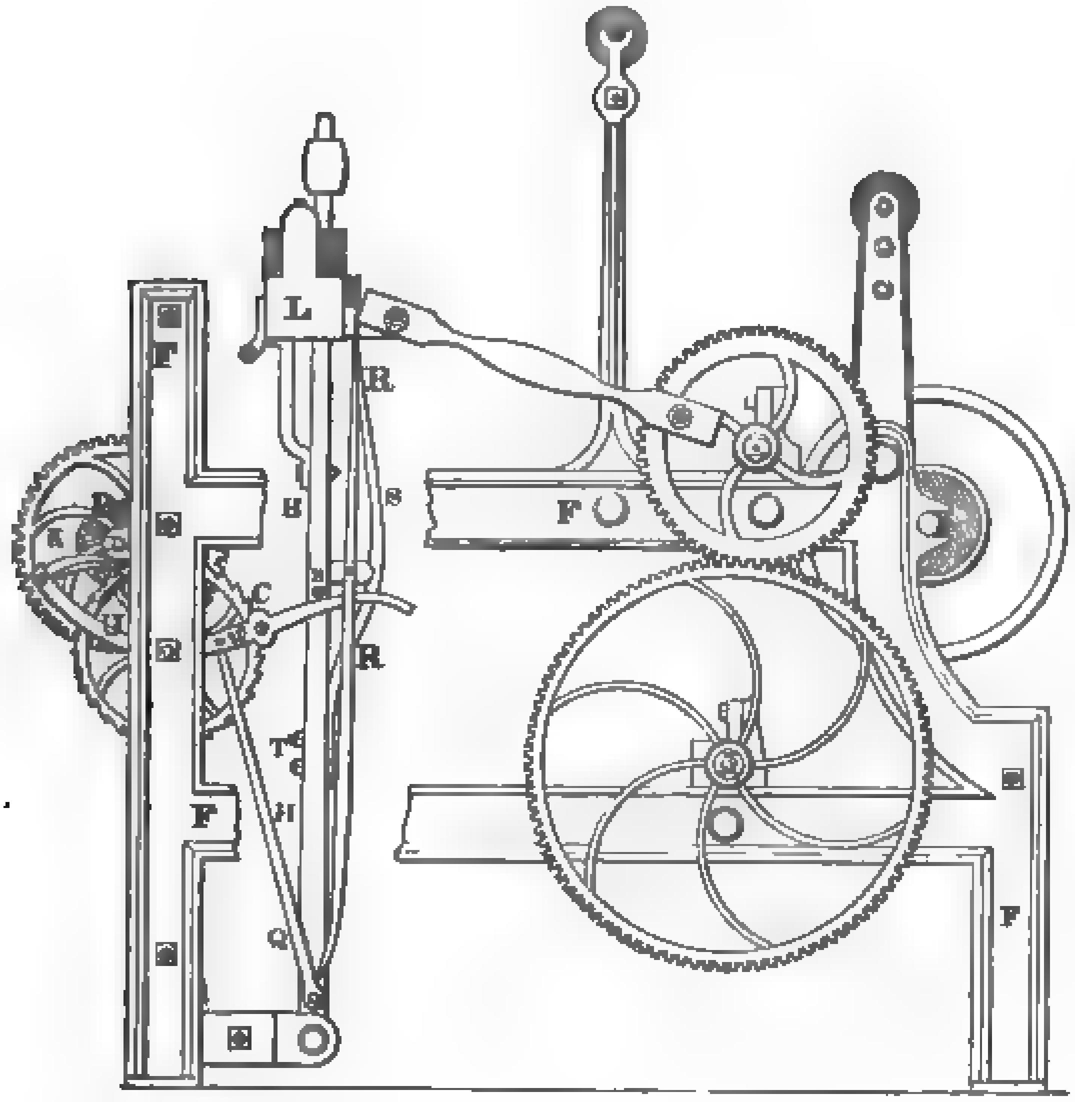
Now, on referring to the subject of Mr. Potter's patent, as shown at Figs. 170 and 171, it will be seen that he has adapted the let-off and take-up motions claimed by Mr. Stone ; for his worm H, shaft F, ratchet wheel G, bar E, lever C, and so forth, are precisely the same ; but he evades Mr. Stone's patent by substituting a mortise or slot L (see Fig. 170) in the rod or bar E, instead of the bent arm X, bolted to the rod or bar S, of Stone's loom (see Figs. 166.) Into the slot L, made in the bar E, Mr. P. inserts the end of the lever

C, instead of connecting it by a pin to the end of the rod or bar S, as in Figs. 165 and 166; and it is the playing of the lever C, against the ends of the slot L, (receiving motion from the vibratory reed) that rotates the ratchet G, on the end of the shaft F (Fig. 170,) instead of the piece X, and so forth, in Stone's loom. Mr. P. makes a catch of the rod or bar E, for turning the ratchet G, instead of inserting a stud-pin into the rod, and putting the click W, on it, as in Fig. 166: but this alteration, of course, amounts to nothing. The jogged end M, of the bar E, in Figs. 170 and 171, answers the same purpose as that shown in Figs. 165 and 166, but is no improvement thereon. The spiral spring 12, in Figs. 170 and 171, is attached to the bar E, and stationary guide J, for the purpose of keeping the bar E, against the teeth of the ratchet G, until sufficient cloth has been woven to cause the under extremity of the lever C (Fig. 170) to draw back, towards the cloth, the bar E, so as to allow its point to drop into a new tooth in the ratchet G: all this justly belongs to Mr. Stone, as any man who is not a downright ignoramus may at once perceive. The modification of Fig. 170, shown in Fig. 171, does not possess any merit, and is only another method of beating about the bush, for the purpose of evading Stone's patent. How in the world Mr. Potter obtained a patent for Mr. Stone's invention, is to us a mystery: surely somebody about the Patent Office must have been magnetized when this transaction took place.

Fig. 172, represents a side view, in elevation, of a common power loom, with another modification of the same apparatus for regulating the taking-up of the cloth; and for which contrivance, a patent was granted to Horace Hendrick, of Killingly, Conn., bearing date 22d Sept. 1836; but it is not worth a straw; and our only object in having gone to the expense of drawing, engraving, &c., and giving it insertion in this work, is, to expose that system which is so extensively carried on by men who have no real talent of their own and are too lazy to get their living by honest means. Mr. H. denominates his appendage, "the rod and sickle;" but we think the term *pruning hook* would be quite as applicable.

F F F F, is the frame of the loom; H H, the sword of the lay; R R, the lever which receives motion from the vibrating reed, and is the same as that marked Q, in Figs. 165, 166, 167 and 168, *n*, *n*, in Fig. 169, and C, in Figs. 170 and 171. The lever R R, in this loom is made to beat up against the inclined rod X, at its lower extremity, near its fulcrum, this rod X, being connected to the arm of the common take-up lever (which is in all respects like that

Fig. 172.



shown at Fig. 169.) L, is the lay; B, a small friction roller or stud-pin fixed on the side of the lay, like that above the letter *y*, in in Fig. 169, except that in this case it is turned upside down, for some purpose *best known* to Mr. H. himself. The arm C, being acted upon by the roller B, will, of course, cause the clicks or drivers K, to turn the cloth roller P. S, is a spring (one at each side of the lay) bolted to the sword of the lay at T, for the purpose of keeping the reed frame in its place, as in Stone's loom, and in the others also, but here it is turned topsy-turvy.

Wherein does the reader suppose the subject of this patent consists? Is it in the lever R R? Is it in the springs S? Or, is it in the clicks K? The only feature of novelty that we can perceive, is in the beating of the nib or under extremity of the lever R R, against the lower part of the connecting rod X, and that too so near its fulcrum that something in the neighbourhood of a horse power, at least, must be required to enable it to actuate the taking-up of the cloth; and this, in our opinion, is improving *backward*.

The rod X, (Fig. 172) being connected by a stud-pin to the lay

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sword at bottom and to the arm C, at top, constitutes a positive take-up motion; and consequently the lever R R, which is actuated by the reed, is useless. Neither do we see the utility of the stud-pin or roller B; because, the rod X, will raise and depress the arm C, which carries the clicks or drivers K, independently of it. The patentee does not tell us how the lever R R, actuates the arm C, through the agency of the rod X, but simply remarks that "the lever R R, communicates motion to the cloth roller by means of the rod X, connected to the *sickle* C." He also says that "the roller or stud-pin B, may be inserted in the lever R R, instead of in the sword H H;" but, we confess our inability to see the utility of so doing, unless the under extremity of the lever R R, were cut away altogether: after which, the motion would be in all respects like that shown at Fig. 169; for if the stud-pin B, were made fast to the lever R R, underneath the arm C, and the roller or stud-pin B, on the lay sword above it, it would answer the same purpose as the turned-up end of the lever *n*, *n*, shown in Fig. 169, with the roller fixed on the sword of the lay below it. But, in this case, it would be necessary to shorten the distance between the reed and the fulcrum of the lever R R, so as to bring the fulcrum nearer to the reed, as in Fig. 169, in order to give the other extremity greater scope for acting on the arm C. Instead of this, however, Mr. H. informs us, that the fulcrum of the lever R R, is midway between the reed and its lower extremity.

As this contrivance is represented, it will only operate as a positive take-up motion, as before stated; and in order to make it actuate the arm C, through the agency of the vibrating reed, the rod X, must be disconnected from the pin *w*, and a long slot made in the end of the rod X, into which slot the pin *w*, may work; this pin *w*, having a suitable head made upon it, to prevent the rod X, from dropping off. This done, if the arm C, is counterbalanced with a weight, similar to that marked 10, in Fig. 169, the roller or stud-pin B, will depress it.

In this position, the lower nib or point may possibly actuate the the rod X, in forcing up the arm C, when a sufficient quantity of cloth is piled up against the reed; but even then we think the odds against the lever R R, will be tremendous, from the relative positions in which these parts are represented by the patentee.

"Emulation," says Mason, "like the other passions of the human mind, shows itself much more plainly, and works much more strongly in some than it does in others. It is in itself innocent; and was planted in our natures for very wise ends, and, if kept un-

der proper regulations, is capable of serving very excellent purposes, *otherwise it degenerates into a mean and criminal ambition.*

"When a man finds something within him that pushes him on to *excel in worthy deeds, or in actions truly good and virtuous*, and pursues that design with a steady unaffected ardour, without reserve or falsehood, it is a true sign of a noble spirit: for that love of praise can never be criminal, that excites and enables a man to do a great deal more good than he could do without it. And, perhaps, there never was a fine genius, or a noble spirit, that rose above the common level, and distinguished itself by high attainments in what is truly excellent, but was secretly, and perhaps insensibly prompted by the impulse of this passion.

"But, on the contrary, if a man's views centre *only in the applause of others, whether it be deserved or not; if he pants after popularity and fame, not regarding how he comes by it;* if his passion for praise urge him to stretch himself beyond the line of his capacity, and to attempt things *to which he is unequal; to condescend to mean arts and low dissimulation for the sake of a name: and in a sinister, indirect way, sue hard for a little incense, not caring from whom he receives it; his ambition then becomes vanity.* And if it excite a man to wicked attempts, make him willing to sacrifice the esteem of all wise and good men to the acclamations of a mob; to overleap the bounds of decency and truth, and break through the obligations of honour and virtue, it is then not only vanity, but vice.

"To correct the irregularity and extravagance of this passion, let us but reflect how airy and unsubstantial a pleasure the highest gratifications of it afford; how many cruel mortifications it exposes us to."

"There is," says another writer, "no greater act of injustice, none more detrimental to society, than to withhold or withdraw the meed of *renown* from the *real benefactors* of our race.

"A desire to possess the esteem and gratitude of our fellow creatures, though not the highest, is yet one of the most legitimate motives of meritorious exertions; one which should never be wantonly repressed by giving currency to either contemporary or posthumous calumny against a useful citizen."

These sentiments are, in our opinion, so just and at the same time so well expressed, that the intelligent reader will at once perceive their applicability to those subjects which we have just been con-

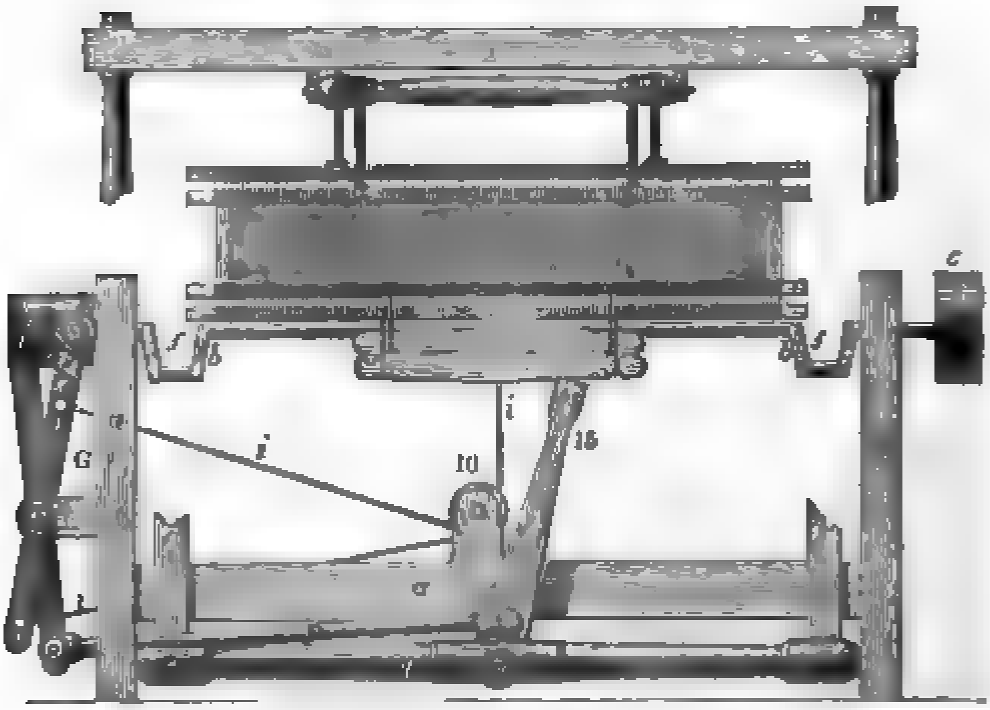
sidering; and no apology will be required for inserting them in this place.

Fig. 173, represents a front elevation of a power loom, showing a novel method of working the headles, as well as of throwing the shuttle;* and Fig. 174, is a view of the crank or driving shaft detached from the loom.

The nature of this improvement consists, in constructing the crank or driving shaft with a cylindrical cam on one end of it, as shown to the left in both Figs., a groove being made round the periphery of this cam, by means of which, in connexion with an intervening lever and straps, the headles are worked; and also another lever of similar form receives its motion in the same way, for the purpose of throwing the shuttle. The latter of these levers communicates motion to the picker staff, by means of a connecting rod, at its lower extremity, as shown in Fig. 173.

Fig. 173.

Fig. 174.



a a, is the frame of the loom; *b b*, the crank shaft, carrying the fast and loose pulleys *c*, on one end, outside the frame, and on the

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* A patent for this improvement, was granted, in the United States, to Frederick Downing, bearing date 27th Jan. 1843.

opposite end, the cylindrical cam *d*, having two spiral grooves *e e*, crossing each other; and *f f*, cranks of the shaft *b b*. In the groove of the cylinder cam *d*, two slides are fitted on opposite sides; the one on the front side is attached to the lever G, which has its fulcrum on the shaft *h*, and turns freely thereon; near each end of the lever G, a slot is made, in which stud-pins *g g*, are so fastened as to be adjustable (by proper screws and nuts:) to these studs are affixed the straps *i i*, which extend from thence under two pulleys 10, and up to the headles; one strap being attached to each headle.

It will be perceived, that by this arrangement, the headles will be worked as the lever G, is vibrated, by means of the button or slide at its upper end, working in the groove *e e*, made on the circumference of the cylinder *d*. The slide or button in the groove *e*, on the opposite side of the cylinder, is connected so as to be adjustable to the upper end of the lever *k*; which lever also has its fulcrum on the shaft *h*: this shaft is on the outside of the loom frame, parallel with its side, and below the cylinder *d*, at right angles to the crank shaft; all of which will be easily understood on examining Fig. 173. The lever *k*, is connected to the picker staff 15, by means of the rod *p*: this rod has its fulcrum at *o*, at the under end of the lever *k*. The fulcrum of the picker staff 15, is at the centre of the lay rocker *q*; the top being connected with the pickers in the usual way. By this combination, it will be perceived that as the cylinder cam *d*, on the end of the driving or crank shaft *b b*, revolves, and vibrates the lever *k*, from right to left, and vice versa, the shuttle will be thrown.

The dispensing with cams and treadles is certainly an advantage: but, this was effected by Mr. Stanfield, of Leeds, as far back as the year 1835. Messrs. Sharrocks and Birch, loom makers, of Great Ancoates street, Manchester, had the construction of Mr. Stanfield's machine; but it appears that they did not succeed in prevailing on manufacturers to adopt it; and, we believe that Mr. Downing's modification of Stanfield's loom will never come into very general use either, for the following reasons:—

1st. It is only applicable where two leaves of headles are employed;

2d. It is only applicable for weaving light textures, where but little power is required;

3d. The rapid motion of the crank shaft *b b*, will soon wear out the small slides or buttons which work in the grooves *e e*, of the cylinder *d*, and this would be found a great evil in a large weaving

room containing some 500 or 600 looms; but in a small concern, it would not, perhaps, be much felt; and although the slides or buttons were made of steel, we think this defect would not be remedied; for, if the slides were of harder metal than that of the cylindrical cam *d*, the grooves of this cam would be worn out first, instead of the slides: in either case a *clitter-clatter* would be the consequence; and

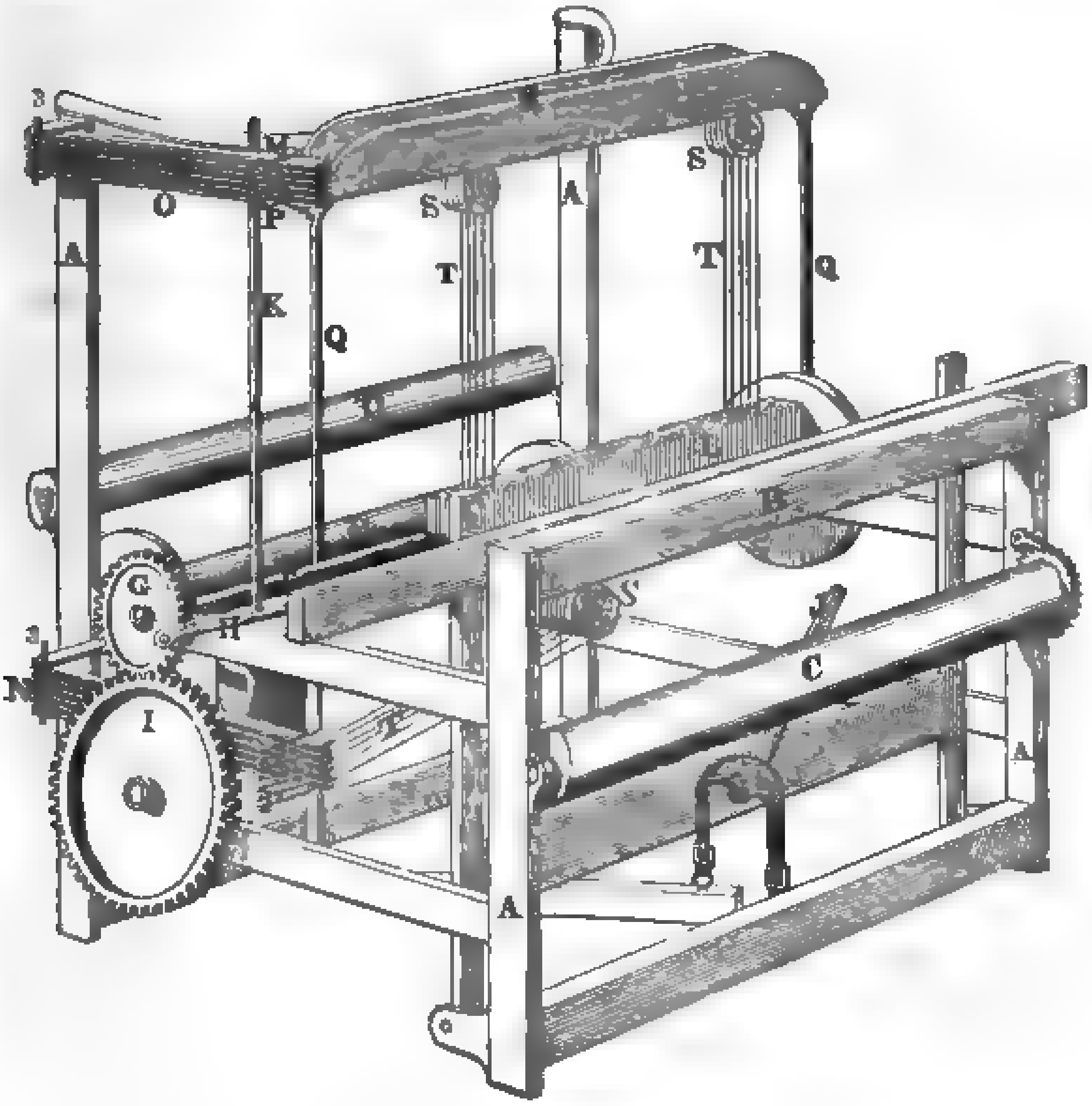
4th. For heavy textures (plain) the strain would be too great on the cam *d*, as well as on the bearing of the shaft *b b;* but the motion for throwing the shuttle might possibly be found applicable; although, we think, with disadvantage as Mr. D. has got it; for in the working of the headles, as well as in throwing the shuttle, the whole of the strain comes on the small slides or buttons which work in the grooves *e e*, of the cylinder cam *d*.

The patentee informs us, that, he fixes a disc on the shaft *h*, near the lever *k;* from the face of which disc, two guages project, one on each side of the lever *k:* these guages have set screws in them to regulate the distance the shaft shall be turned round by the vibration of the lever *k*. This disc is omitted in the Figs., for the simple reason that, it will not effect what the patentee tells us, as neither a quicker nor a slower motion can be given to the lever *k*, than that which it receives from the grooves *e e*, of the cylinder cam *d*.

Figs. 175, 176 and 176½, represent an improved satinett loom, as constructed by Elijah Fairman, of Stafford, Connecticut; and for which he obtained a patent in the United States; bearing date the 6th of February, 1838. The subject of Mr. F's. patent is in the application of an additional cams, or cam, to the horizontal treadles or levers shown in Fig. 176; which levers it will be seen have their cam shoes in opposite directions, the top set of shoes to the left and the bottom set to the right. Mr. F. also claims the application of the additional set of cords or strings connected to the under extremities of these upright treadles or levers; which cords or strings pass under a set of pulleys to the left, as shown in Fig. 176, and are then connected to the headles underneath.

The treadles lie horizontally, one set near the bottom of the loom, and the other set near the top. Each set of treadles is supported at their outer end by two short arms or bars, projecting from one of the back corner posts of the loom; between which the ends of the treadles are placed one upon another, and a pin or bolt 3, 3, passes through them and the supporting arms. The other ends of the

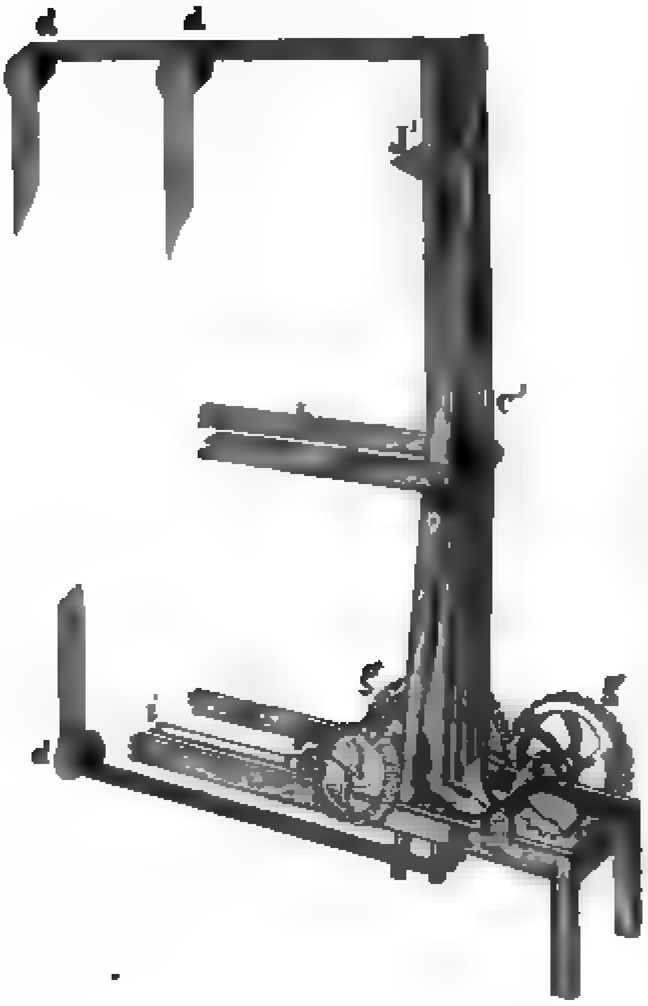
Fig. 175.



treadles are supported by short thin pieces of iron or wood, fastened to short posts or studs in the frame, projecting out horizontally, one underneath each treadle, forming rests and slides for the treadles to play upon. Each treadle has an iron shoe fastened to its front edge, of a triangular form, on which the cam acts to give the treadles motion. To the end of each of the upper treadles are attached two cords, one of which passes over one pulley, and the other over another pulley, suspended between two headle rails at the top of the loom, and passing down, are fastened to the headles, one near each end.

To the end of each of the under treadles, is attached one cord, which passes under a pulley in the lower part of the loom, and coming up, is fastened to the under side of the same headle in the centre. These cords hold the headle firm that it cannot move up or down, till moved by the treadle; and when one part of the headles is raised, the others are held down, so that the warp opens to let the

Fig 176



shuttle pass freely. The cams by which the treadles are worked are placed near the top and bottom of an upright shaft, so as to match with the shoes of the treadles, and are so arranged that when an upper cam strikes the shoe of one of the treadles to raise a headle, the corresponding treadle in the lower set attached to the same headle, gives way to the motion, by its shoe being drawn into an appropriate space in the cylinder cam; and when the upper cam has passed the shoe of the treadle, the treadle is drawn back to its place again, by the shoe of the under treadle being thrown out of its space, and pulling upon the headle cord. By these alternate movements of the treadles, by the aid of an additional cam, the action is made free and easy, and the headles kept closely confined to their places, and made to open wider and more clear, that the shuttle may pass without danger of over-shots.

The cam shaft is turned by means of a bevel gear on the bottom of the cylinder cam, driven by a pinion on the cam shaft (see Fig. 176½.)

Another method of producing the same motions and effecting the same object, is to have but one set of long double treadles, standing upright, extending from top to bottom of the loom, and turning upon a pin in the centre, which passes through them, and a short

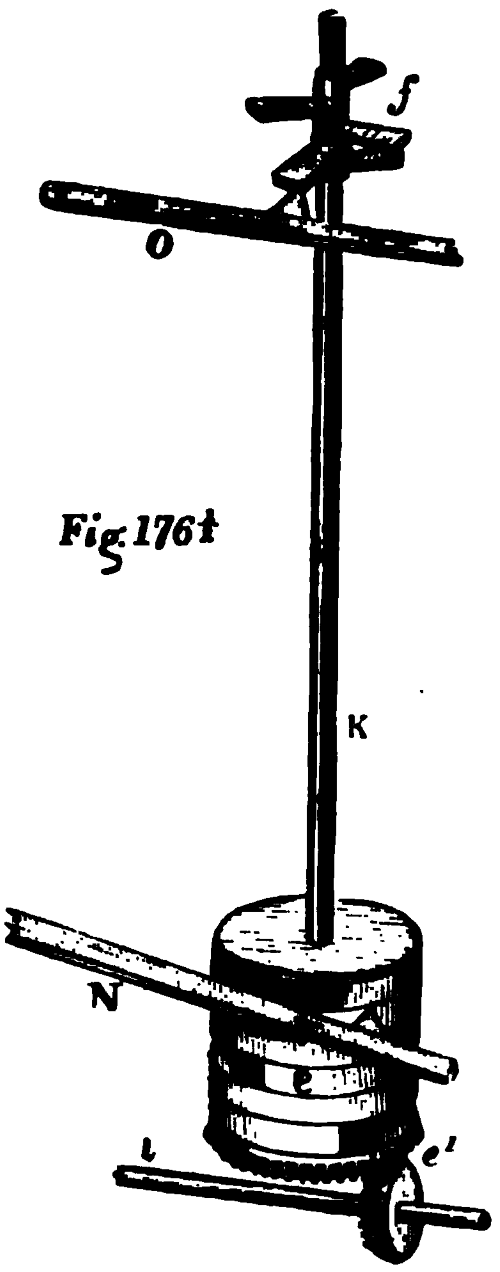


Fig. 176½

arm or bar on each side, firmly attached to the loom, to support the treadles, as in Fig. 176.

The cams, such as already described, are placed horizontally between two bars or arms attached to the frame of the loom at one end, and at the other supported by a post or posts, standing upon the floor. The lower ends of the treadles have a shoe on each side, exactly opposite, and stand directly between the cams. The cams are carried by a bevel gear and pinion similar to those by which the horizontal treadles are moved; the pinion being placed upon the end of the cam shaft. By the action of the cams on each side of the treadles, they are thrown alternately one way and the other, giving the same motion to their upper ends, but in a contrary direction.

But as this loom is nearly the same as those in common use, it is not necessary to describe more particularly its parts; reference to the Figs. will suffice:

Fig. 175, Perspective view of the loom.
A A A A, The 4 corner posts of the frame.
B, Breast beam.
C, Cloth roller, with ratchet wheel, &c.
D, Back whip roller.
E, Yarn beam, with heads.
F, Driving shaft.
G, Driving wheel.
H, Lay arm, connecting the lay with the crank wheel G.
I, Cam shaft wheel.
J, The picker staff.

K, Cam shaft.
L, Headles.
M, Separate cams by which the upper treadles are worked, one to each treadle.
N, Lower treadles. } Each treadle has an iron shoe on which the cam acts. (See Fig. 176½.
O, Upper treadles. }
P P, Bars to separate and support the ends of the treadles, and on which the treadles slide.
Q Q, Posts to support the headle rails, &c.
R, Headle rails, between which the headle pulleys are hung.
S S S, Headle pulleys.
T T T, Headle cords. From each upper treadle pass two cords, one over each of the top pulleys, and fastened to the headles near each end. From each bottom treadle, one cord, passing under the under pulley and fastened to the centre of the bottom of the headles.
Fig. 176, Represents the upright double treadles, and the mode of operation.
a a, Two arms or bars, attached to the frame of the loom; either to the cross girt or otherwise, as judged best, and supported by a post or posts, standing upon the floor.
b b, Two arms attached to the frame, between which the treadles are placed and are supported, and turn upon a pin passing through them and the arms.
C′, The treadles.
d d d, The headle cords and pulleys over which they pass.
e, The cylinder cam, and *e′*, bevel gear and pinion, as in Fig. 176½.
f, Upper, or 6 part cam, as in Fig. 176½.
g g, Two match wheels on the outer ends of the cam shafts.
h, Shoes on each side of the treadles.
i, End of the cam shaft.
J′, Shoe on the upper end of the treadle. Shows that the same operation may be had by placing one of the cams at the top, and on the same side as the one at bottom.
Fig. 176½, Represents the cylinder cam at the bottom of the headle cam shaft, with the bevel gear, and the pinion on the cam shaft; and the grooves on the cam into which the shoes of the treadle fall alternately, or are driven in as the corresponding treadle is thrown out to raise the headles. It also shows the form of the cams on the upper end of the shaft, and one of the treadles as operated upon by a cam; the cam is on its end a 12th part of a circle, and the 6 are cast in one piece, one cam above another to match the treadles.

The connexion by cords from the bottom of the headles to the ends of a series of horizontal or vertical levers *is not new*.

The vertical levers having shoes at each end, on opposite sides, as shown in Fig. 176, with their mode of operation, will, no doubt, answer for looms where a few leaves of headles only are necessary; but in looms for weaving fancy textures, where from 10 to 100 leaves are required, Mr. F's. plan would be utterly impracticable. In such looms, in order to comprise as many leaves as possible in a small compass, they are made of different depths, and their respective shafts are arranged one tier above another, to a sufficient height to prevent them from touching when the sheds are opened. Thus, for example, were a mounting to consist of 90 leaves, which is not uncommon for some of the finer kinds of silk patterns woven in Spitalfields, and were the shafts made about ⅛th of an inch thick, the whole, by arranging them in three tiers of thirty shafts each, might be comprised in about the space of 5 inches. In such cases,

neither the vertical treadles or levers, shown in Fig. 176, nor the horizontal treadles, represented in Figs. 175 and 176½, would answer at all, owing to the space they would occupy; for it would be necessary to make them sufficiently thick to bear the strain required for opening the various sheds. European weavers always use sinking cords attached to suitable levers, in connexion with raising cords, and, indeed, they cannot do otherwise in the manufacture of various kinds of tweeled and fancy goods. For further illustration of this subject, see Section Second.

An invention for stopping the loom when the weft thread breaks, was made the subject of a patent by O. M. Stillman, of Stonington, Conn., in November 1841. This improvement consists in making the loom stop of itself when the weft thread breaks or becomes exhausted, by the aid of a contrivance fixed on the breast beam near its centre and directly in front of the lay. The loom represented in the Figs. is of the usual form, showing the stop-thread motion attached: the same letters of reference indicate similar parts in the Figs.

This contrivance consists of a small iron plate *e*, Fig. 177, on the upper side of the breast beam, under the cloth; on the under side of the plate *e*, is placed a slide *s*, the part under the plate being in the form of a staple, and extending back to the square hole in the plate, so as to come against the pin *b*, which stands up in the hook *a*; the other end being a small bar with a series of pins or teeth.

A piece of iron B, Fig. 178, is placed on the under side of the breast beam below the plate *e*, and is supported by a bolt passing through it into the breast beam, but left sufficiently loose on the bolt to allow of vibration.*

The hook *a*, is attached to the inner end of the piece B, by a pin on which it works easy, so that the hook *a*, may rise and fall. The pin *b*, is made fast in the hook piece *a*, as shown in Fig. 178, and stands up near the breast beam, passing through the hole in the plate *e*, as rèpresented in Figs. 178 and 179. A small spring *v*, fastened on the front of the breast beam, presses the pin *b*, forward against the slide *s*, which carries the small pins or teeth. A piece of steel *d*, is riveted to the side of the iron B, making a right angle with it, and set so as to lap on the end of the shipper *k*, which is hung on the under side of the breast beam, and extends a little be-

* It would be difficult to apply this motion of Mr. Stillman's to looms where a roller was used instead of a breast beam.

Fig. 177, 178 and 179.

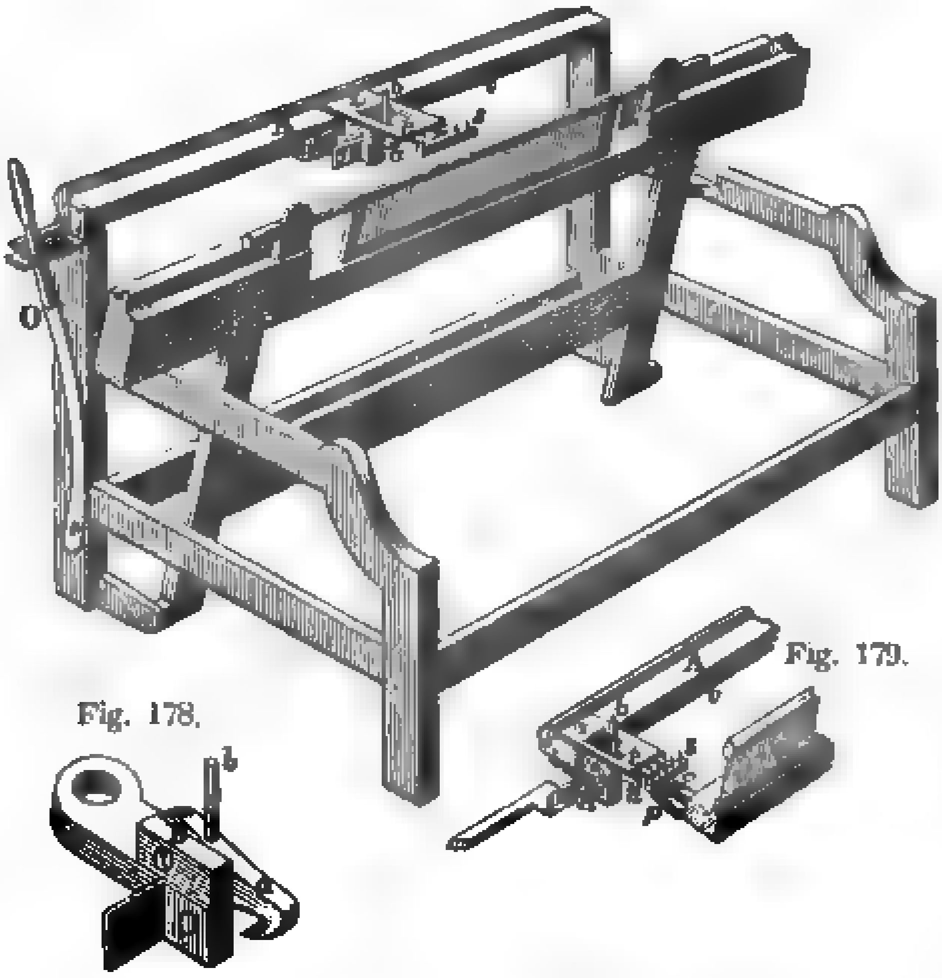


Fig. 178.

Fig. 179.

yond the vertical lever *o*. This lever *o*, is of the ordinary description; and it is by it, through the agency of the protecting pin *p*, Fig. 179, striking against the point *k*, of the horizontal lever underneath the breast beam that the belt is shifted from the tight pulley on to the loose one.

When a thread of weft is thrown through the shed, ***the reed brings it up against the teeth of the slide s; which teeth are also brought up to the cloth***, the inner end of the slide *s*, forcing the pin *b*, back towards the breast beam, ***bending the spring v***, and raising the hook *a*, (Fig. 179) passes under it without collision.* ***The teeth, being thus woven into the cloth, are held by the thread until the lay is carried back and the headles change position by springing open a new shed, the action of which operation raises the cloth sufficiently to set the pins free, when the spring v jerks them forward in the warp, ready to receive another weft thread.***

---

* ***The weft thread must be strong enough to enable the slide s, to overcome the elasticity of the spring v. This we consider to be a very serious defect; because the contrivance could not be used with certainty on looms for weaving fine or delicate textures on that very account, even if it had no other fault.***

When there is no weft thread to hold the teeth, they follow the reed as it moves forward, thereby letting down the hook *a*, in time to come in contact with the permanent oblique hook *c*, (Fig. 179) against which it slides, forcing the piece B, sidewise, turning on its bolt, which brings the steel piece *d*, against the lever *k*, driving it back sufficiently to cause the other extremity behind the vertical lever *o*, to stop the loom, as in case of the protecting pin *p*, (Fig. 179) striking it in the ordinary way. The motion of the steel piece *d*, being circular, it slides on the lever *k*, a little as it takes it back, which brings the steel piece *d*, before the protecting pin *p*, and stops the lay should its momentum carry it far enough after the belt is thrown off the tight, on to the loose pulley.

This contrivance might be added, with considerable advantage, to looms for weaving wide textures, where the speed is only 38 or 40 picks of weft per minute; but for looms of much greater velocity, it would not answer at all; and this will be evident enough when we consider the mode in which the slide piece *s*, carrying the pins or teeth, is acted upon by the weft thread and reed. Indeed, the very rapid motion of some looms would soon injure that part of the reed which came in contact with the pins in the slide piece *s*. We think that the action of the needles or pins in the slide *s*, in entering between the threads of warp, would be very uncertain, or *hap-hazard*. The needles or pins should not be made sharp at their points, as they would be very apt to *split* any warp threads with which they came in contact in their ascent; neither should they be too blunt, as they would break the threads. This motion is not applicable to looms for weaving figured goods, nor to those where the cloth does not spring or become elevated during the process of forming the shed; *because the pins could not disengage themselves from the cloth* in such looms. These obstacles, with many others which we could mention, will prevent Mr. Stillman's motion from becoming of any great practical utility.

Mr. William Thomas Shallcross, of Holt Town, near Manchester, obtained a patent in January, 1833, for improvements in power looms. The first part of the improvement consists, in driving the shuttle with greater rapidity, and the second, in a new mode of working the headles and taking up the cloth.

The patentee considers, that the construction of a power loom being well understood, it is not necessary for him to describe one, but only to point out those variations in parts of the mechanism which he claims as improvements. The contrivance by which the first object is to be effected, is represented in his drawings in perspec-

tive upon a very small scale, and it is so indifferently described that we can only understand, that, there is a pinion which takes into the crank wheel, and that to a pin in this wheel a connecting rod is attached, which is also attached to a double crank. Then follows a series of other wheels, rods and cranks (which we have in vain attempted to link together,) and ultimately the movements thus obtained, drive the picker staff and causes the shuttle to rush through the shed with the utmost desperation. Several variations of the arrangement of mechanism, accompany the specification, but all are equally obscure: the patentee says, that by these means he renders a loom "*less complicated than heretofore*," and that by it "labour and materials are economized," and that "the power for driving the loom will be greatly diminished;" all of which, if true, we regret we have not been able to discover. The other features are rendered equally unintelligible, by the smallness of the figures, the obscurity of the description, and the absence of letters of reference in many parts. The inventor does not claim the framing of the loom; which in our opinion is a very great oversight on his part.

Thomas Welch, of Manchester, cotton spinner, obtained a patent in October, 1833, for a method of producing a *varied degree of speed in taking up the cloth.* By the usual method, as the cloth is wound round the cloth roller every additional fold increases its diameter; so that each succeeding fold is wound on with a greater degree of speed than the one preceding it, whereby the texture of the cloth is impaired, and the number of picks to an inch is lessened. The following is the mode of applying Mr. Welch's invention to a power loom:—

A block of wood is provided, which the patentee calls a *saddle*, the face of which is hollowed out, so as partially to clasp the cloth roller, and the greatest diameter of cloth to be rolled on at one time before cutting it out of the loom. This saddle is connected, by a joint pin, with the short side arm of an upright crank lever, affixed to the framing of the loom; from the centre of this lever, a long front arm protrudes, having a forked end which guides an endless strap or band that passes over two conical drums (like that marked S, in Figs. 5 and 6, Plate III) one of which is on the tappet shaft of the loom, its broadest end being nearest the centre of the shaft; the other drum is on a counter shaft, near the cloth roller, its end being farthest from the centre of the shaft. Motion is communicated to this drum from the drum on the tappet shaft by means of the endless band just mentioned.

The outer end of the counter shaft is provided with a pinion,

which drives a series of wheels and pinions;—these communicate motion to a wheel, fastened on the end of the cloth roller, which is thus caused to revolve. One of the wheels, and one of the pinions are provided with a catch box, to which is attached a spring lever by which they may be thrown in or out of gear as occasion requires.

At every succeeding fold of cloth added to the roller it will gradually push the short side arm of the crank lever back, by pressing against the saddle; by this means, the lever will be turned partly round, and its long arm will cause the endless band to traverse towards the pointed end of the drum on the counter shaft, by which means the last mentioned drum will be caused to revolve more slowly; therefore, slower motion will be communicated to the cloth roller, by the wheels and pinions, but the cloth (says the patentee) will be wound on with the same degree of speed as at first, owing to the increased diameter of the cloth beam.

In order to insure steadiness of action, when applying this invention to the taking-up of the cloth, having a large number of picks to the inch, the patentee adopts the following arrangement of parts:

From the back of the saddle, a flat bar of iron extends, and is formed into a rack;—this bar travels in an eye, attached to the centre of a bar, one end of which is fastened to the breast beam of the loom, and the other end extends out, and forms a support for an upright axle. To the upper part of this axle, is fastened a small spur wheel, which is worked by the rack before mentioned; and to the lower part of this axle, is fastened a large spur wheel, which works a rack, provided with a pair of prongs;—these prongs act on the endless bands.

The saddle is kept in contact with the cloth roller, by means of a spring, and the other parts remain the same as before; the motion of the cloth roller being varied by the traversing of the endless bands. The following is the mode of applying this contrivance to a hand loom:—

The saddle, upright crank lever, and its arms, as well as the pinions and wheels which turn the cloth roller, are the same as in the first instance, with the exception of the catch box and spring lever, which are removed for the reason hereafter explained.

The drum, which was before on the tappet shaft, is now fastened on a crank shaft, having two cranks, and is steadied in its revolutions by a fly wheel, at one or both ends. This shaft is turned by two crank arms, extending from the lay to the crank, and it communicates motion, by means of an endless band (and two stout

Irishmen) to the other drum, which is fastened on a counter shaft, the endless band being caused to traverse by the long arm of the lever, in the manner above described.

The patentee says, in concluding his specification, that "when the lay ceases its vibrations the whole must stop; therefore, the catch box and spring lever, for throwing the wheels and pinions out of gear, in order to stop the cloth roller, are useless;" to which we respond, yaw! yaw!! yaw!!! That the machinery of a common power loom should continue its regular evolutions after the lay ceases to vibrate, is, indeed a mysterious affair; and is well worthy the attention of the learned. The looms represented at Figs. 161, 162, 163 and 164 will accomplish the object of this patent with much greater precision and simplicity; to which Figs. the reader is referred.

The cone drums, applied to looms for taking up the cloth in the way claimed by Mr. Welch, is an old German idea, and is not worth a stiver.

Thomas Mellowdew, of Walshaw Cottage, Oldham, Lancaster, mechanic, obtained a patent in May, 1838, for improvements in looms; which improvements consist in certain machinery to be attached to looms for weaving various kinds of cloth; and *set in motion by the pull, strain, or jerk given to the warp threads by the blow of the reed in beating up the weft;* and which produces by its action a regular, corresponding, and sufficient delivery from the warp-beam, and taking up of the cloth on the cloth-roller so long as there is weft-thread added; but which delivery and taking up cease, in case of the breaking or non-delivery of the weft, or *shortly afterwards*, in consequence of the reed on being at such times struck up, meeting with a *diminished* resistance, inadequate to cause a sufficient pull, strain, or jerk upon the warp threads, to produce the effect required, although the general evolutions of the loom continue.

We need not here recapitulate the immense long yarn given by the patentee, as explanatory of his invention, as all that it effects may be accomplished by the loom represented in Fig. 171, by that shown at Figs. 165, 166, 167 and 168, or by that at Fig. 169: either of which looms is far superior (both as regards working and simplicity of construction) to Mr. Mellowdew's, as any manufacturer pretending to a knowledge of such subjects will at once perceive. In summing up his specification, Mr. Mellowdew says, "what I claim as my invention, is the causing the pull or strain upon, or jerk of the warp-threads, occasioned by the blow of the

reed in beating up the weft when sufficient resistance has been presented to it by the supply of the weft from the shuttle to produce, by means of a vibrating carrying roller, (whip-roller) supported on vibrating levers, and acted upon by the jerk of the warp with the other machinery herein described, when attached to looms for weaving various kinds of cloth, a regular corresponding, and sufficient delivery of yarn from the warp-beam, and taking up of cloth on the cloth roller, so long as the proportionate filling up of the weft continues, but which delivery and taking up will cease in case of the breaking or non-delivery of the weft, or *shortly afterwards*, in consequence of the reed, on being struck up, meeting with a diminished and inadequate resistance, and, therefore, causing a diminished pull, strain, or jerk." All this, as we before observed, may be effected with the modification of Mr. Stone's loom, shown at Fig. 171; and which modification was made the subject of a patent in the United States, as formerly stated, 23d November, 1837, about six months prior to the date of Mr. Mellowdew's patent.

We might here give accounts of some 50 or 60 other contrivances which have been made the subjects of patents in Great Britain, France, Belgium and America, for several years past, for governing the delivery of the warp and the taking up of the cloth in common power looms; but none of which contrivances are at all equal in point of practical utility or simplicity to those shown at Figs. 165, 166, 167, 168, 169, 170 and 171. For weaving delicate textures, such as gauze, light silk stuffs, &c. positive take up motions (in connexion with a motion to stop the loom when the weft thread breaks or becomes expended on the cop or bobbin) must be used instead of the vibrating reed; we shall, therefore, close this part of our subject by referring the reader to Section Twelfth.

SECTION ELEVENTH.

FANCY WEAVING.

" The wise and prudent conquer difficulties
By daring to attempt them. Sloth and folly
Shiver and shrink at sight of toil and danger,
And make the impossibility they fear."—Rowe.

By the term *fancy weaving* we mean the weaving of those small patterns which are produced in looms mounted with leaves of headles; and of which we have already given sufficient explanation in Sections Second and Third.

For a complete description of the method of weaving figured patterns of *unlimited extent, by power*, see next Section. In the present section we shall confine our remarks to those looms for weaving fancy textures which we consider to be of most practical utility, with such other information as has a direct bearing on the subject; and, in the outset, it may, perhaps, not be amiss to offer a few observations on fancy textures in general.

The smaller mountings, with leaves of headles, produce but a very limited variety of patterns, commonly a small diamond or lozenge figure, with a dot or speck in the centre, which gives it the resemblance of an eye: hence these figures are generally denominated bird-eye patterns. When the mountings, however, extend to eight leaves and upwards, they admit of considerable diversity in flushing, tweeling, and plain texture, deviating from the formal figures of the bird-eye, and which now assume the appearance of what is called lined work.

The draught of lined work patterns may be considerably diversified by dividing the leaves into two equal portions, and drawing a few sets of the diamond draught on each portion, alternately. This arrangement throws the group of small figures produced by each set of leaves, into alternate squares, somewhat resembling the dam-board pattern, shown at Fig. 36, Section Second. It is customary, however, to introduce an odd leaf into these mountings, immediately between the divisions, which serves as a point leaf to both sets.

Any number of concentric figures may be formed, by repeating

the draught several times over the leaves in one direction, and returning in the contrary direction as often: so that should the draught diverge from the centre of the cloth toward each selvage, and the treading continue to the same extent, the pattern would be one great figure, composed of concentric squares, whose dimensions and variety would depend on the number of leaves, and the arrangement of the raising cords.

Tweeled and plain textures.—For patterns of this kind, the mountings will consist of one set of plain, and one set of tweeling leaves, and the raising and sinking cords of the plain mounting are tied alternately on the tweeling treadles. It must be observed, however, that in all mountings which have an odd number of tweeling leaves, double the number of treadles are requisite, in order to make the plain sheds alternate without interruption.

All tweeled stripes, which have an even number of tweeling leaves, are woven with one set of tweeling treadles, as the sheds of the plain parts can then be made alternate without any interruption.

Where the pattern will permit, the greater portion of the tweeling leaves should be sunk, and therefore, the weft will appear to most advantage on the upper side of the cloth while in the loom. Besides this advantage, the strain on the machinery will not be near so great, in raising the smaller portion of leaves.

Sometimes the draught of a tweeled stripe is made in the diamond form, and the pattern produced is commonly called a dart stripe, or herring bone.

When a web is to be tweeled across, in order to form checks or the borders of handkerchiefs, the same number of leaves must be employed for the ground that are requisite for the tweeled stripe. Thus, to convert a four leafed tweel stripe into a check, the common mounting of four leaves, will produce a similar tweel across the web. But should the stripe be woven in a six or eight leafed tweel mounting, the plain parts must also be drawn on six or eight leaves, and each leaf is corded so as to rise and sink alternately in the plain parts, but to produce the tweel in the check. Hence it will appear, that a stripe with an odd number of tweeling leaves will not admit of a similar tweel for the crossing or check, as the ground leaves must always be divided into equal portions in weaving the plain parts.

Any tweel of an even number of leaves may be converted into stripes and checks; and if the stripe be formed into a dart or herring bone, the plain may be woven by a single over and over

draught, and converted into a check the same as the stripe, by working over the treadles in one direction for half of the cross stripe, and reversing the order of treading for the other.

Gauze, veining, purles, spidering, &c. are also variously combined with several of the other branches of fancy weaving, and produce some of the most beautiful and delicate patterns in the *silk* and *cotton* manufactures. To obtain a knowledge of gauze, veining, spidering, &c. the reader must consult Section Fourth.

It must be observed, however, that when gauze and plain are woven in alternate stripes, those parts of the reed which are occupied by the plains will be full; but in the gauze spaces, a dentful of the warp passes through every second interval only; consequently, the set of reed in the former, will, in general, be double of that in the latter. And hence, when additional weft is thrown in, the plain texture will make a pretty bold contrast to the light transparent fabric of the gauze.

As the warp of gauze, when converted into plain texture, produces but a very thin or flimsy fabric, it is necessary to introduce additional warp as well as weft into those parts which are woven plain, which, one being flushed above, and the other below, the gauze spaces, are afterwards cut away. A dentful of this additional warp is taken into the reed alternately with a dentful of the gauze; so that the former, as noticed above, is exactly double the set of the latter.

This method of forming patterns with gauze and cambric, like some of the other branches of fancy weaving, may be extended to all the varieties of a diaper mounting (see Dornic and Diaper, page 112, Section Second:) for any draught of the latter may be adapted to the former, merely by substituting one set of gauze, and one of plain leaves, for each set of the tweel, and varying the succession of the draught and treading accordingly.

It is not customary for the manufacturer to annex the plans of cording to these compound draughts; neither is it always necessary, particularly in extensive business, to represent in the draught every leaf which is requisite in the mounting. All that is commonly required in the draught is, to point out to the headle-maker, the quantity and arrangement of each kind of the warp in one set of the pattern, with the number of times the pattern is to be repeated; and to the weaver, the order of succession in which these several warps are to be drawn into their respective mountings; each being supposed to understand his own department of the business.

The first loom to which we shall turn our attention in this Sec-

tion, is the invention of Mr. Charles Fletcher, an ingenious mechanic, of Stroud, county of Gloucester; and for which he obtained a patent in March, 1838. This loom, being of vertical construction, differs very much from those described in Section Tenth; and although it is not, in some respects, calculated for weaving fancy textures, we think it may, without impropriety, be explained in the present section.

The invention consists, firstly, in a peculiar arrangement or disposition of mechanism, for the purpose of weaving *woollen* goods; and secondly, in the introduction of certain new parts or pieces of mechanism into looms in general, by means of which considerable advantage, as to speed and uniformity of work, is obtained, especially as regards the weaving of woollen cloths.

By these improvements, Mr. Fletcher assures us he is enabled to weave better cloth by power than has *hitherto been accomplished by hand*, the cloth being *much firmer*, and the mechanism affording the capability of making more "picks" per minute, and causing less breaking of the warp threads, thereby producing a fabric of *better quality, and in greater quantity, in a given time.*

In this loom the yarn beam is situated at the bottom of the framing, and the cloth roller is placed at the top (as in E. K. Arphaxad's great weaving engine, pages 24 to 41, of the Introduction.) The warp threads proceed through the headles in vertical positions, while the headles are moved to and fro horizontally. The lay is made to rise and fall vertically by the action of suitable cams and levers, and is impelled upwards by the momentum of a falling weight, or weights, which can be so regulated and adjusted as to increase or diminish the blow, as may, under circumstances, be found desirable. This part of the mechanism is also furnished with suitable elastic regulating stops for the rising lay to strike against at the moment that the reed is beating up the weft, and by the elasticity of these regulating stops, the sudden concussion of the lay, and consequent strain upon the warp threads, is immediately relieved; whilst the blow being caused by a descending weight mounted upon the end of a lever attached to the cam shaft, any degree of impulse can be given to the lay without causing an undue strain upon the warp threads, and with much greater effect upon the cloth than can be obtained by the *best hand weaving.*

In order to illustrate Mr. Fletcher's improvements in the construction of looms, and that they may be more definitely explained, we have drawn the figures on an enlarged scale, which will enable the reader better to comprehend the novel features of the machine.

Fig. 180.

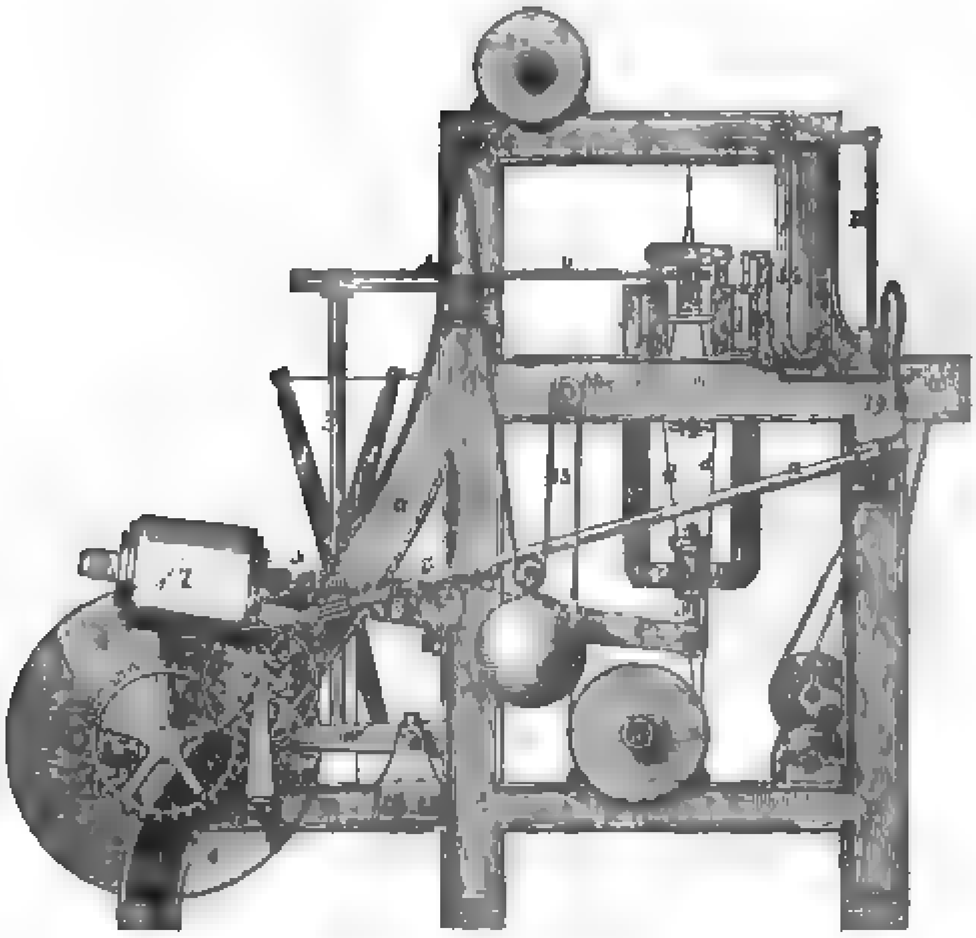


Fig. 180, is a side view of the loom; Fig. 181, a plan view: Fig. 182, a back view; and Fig. 183, a section, taken through the middle of the machine, showing the position of the warp and the apparatus for working the headles.

The side frames, in which the ordinary parts of the loom are mounted, are represented at *a a a a*, being connected by traverses or rods *b b*. *c*, is the yarn beam or roller (see Fig. 183) upon which the warp *d d*, is wound. The warp threads proceed from the yarn beam through the headles *e e*, which slide horizontally in bearings *f f*, affixed to the frame *a a*, on each side.

It will be seen that the cloth, as it is produced by the weaving, proceeds over the breast beam g^2, (Fig. 183) to the cloth roller *h*, at the top of the loom.

The shuttle boxes are shown at *i i*, (Figs. 181 and 182) secured fast to the sides of the frame *a a*, and are quite free from, and independent of the lay or reed.

Upon the main driving shaft *k*, the strap pulley *l* (Figs 180, 181 and 182) is thrown into gear with the driving pinion *m*, by means of the setting-on rod *n n*; and the pinion *m*, being geared with the toothed wheel *o*, which is fast upon the cam shaft *p p*, the toothed wheels *q q* (Figs. 181 and 183) are actuated. The larger of these

Fig. 181.

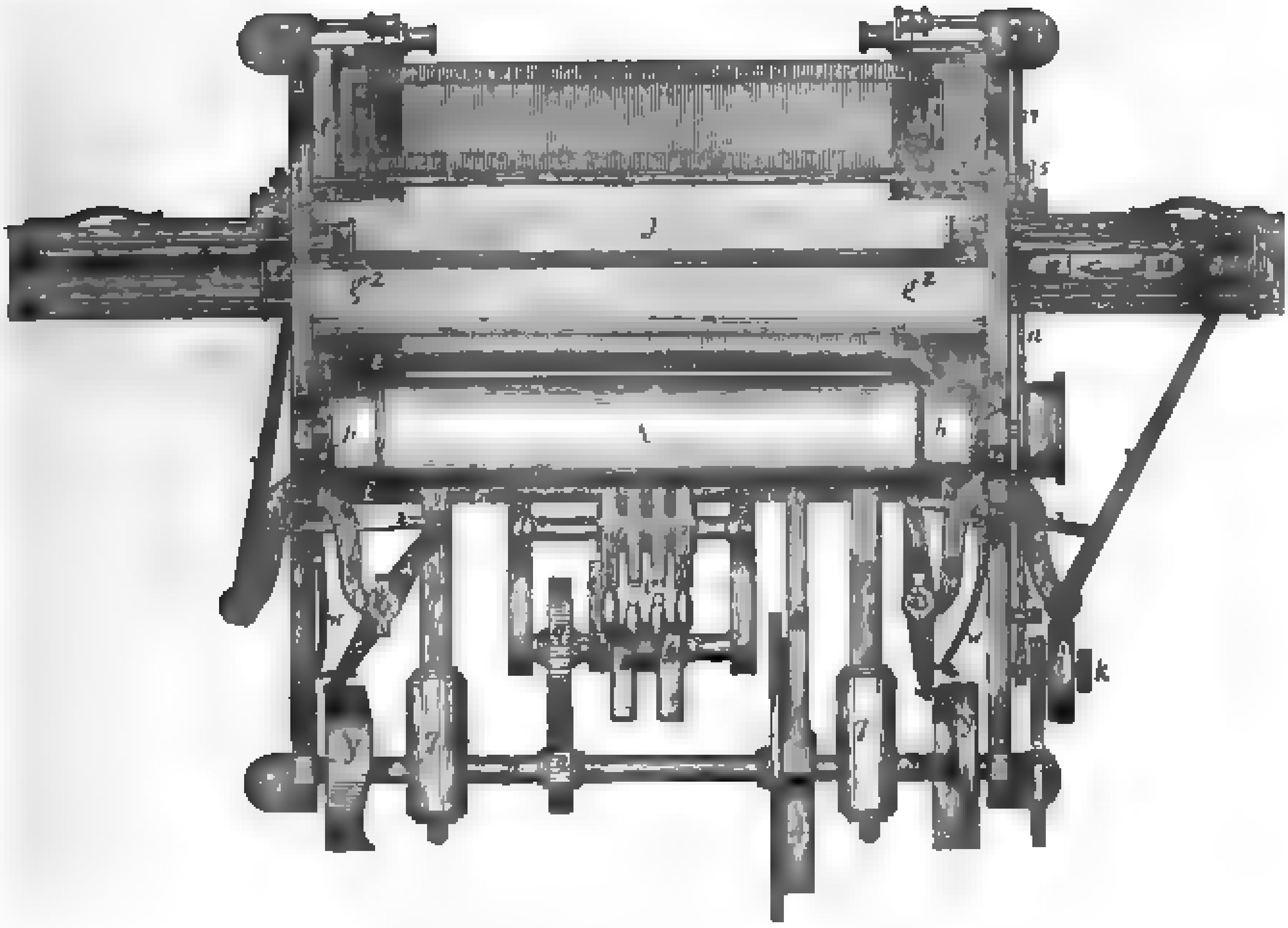


Fig. 182.

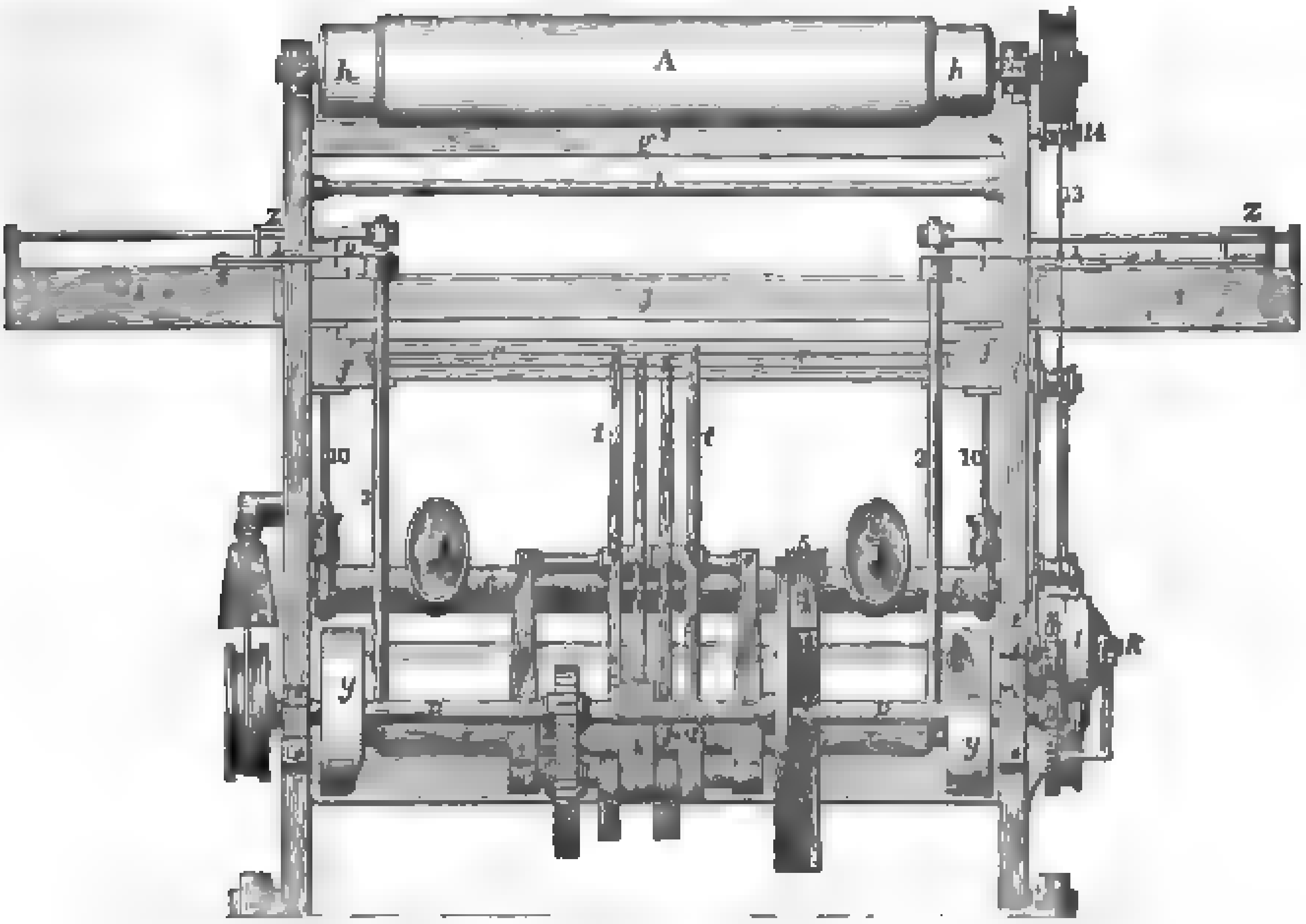
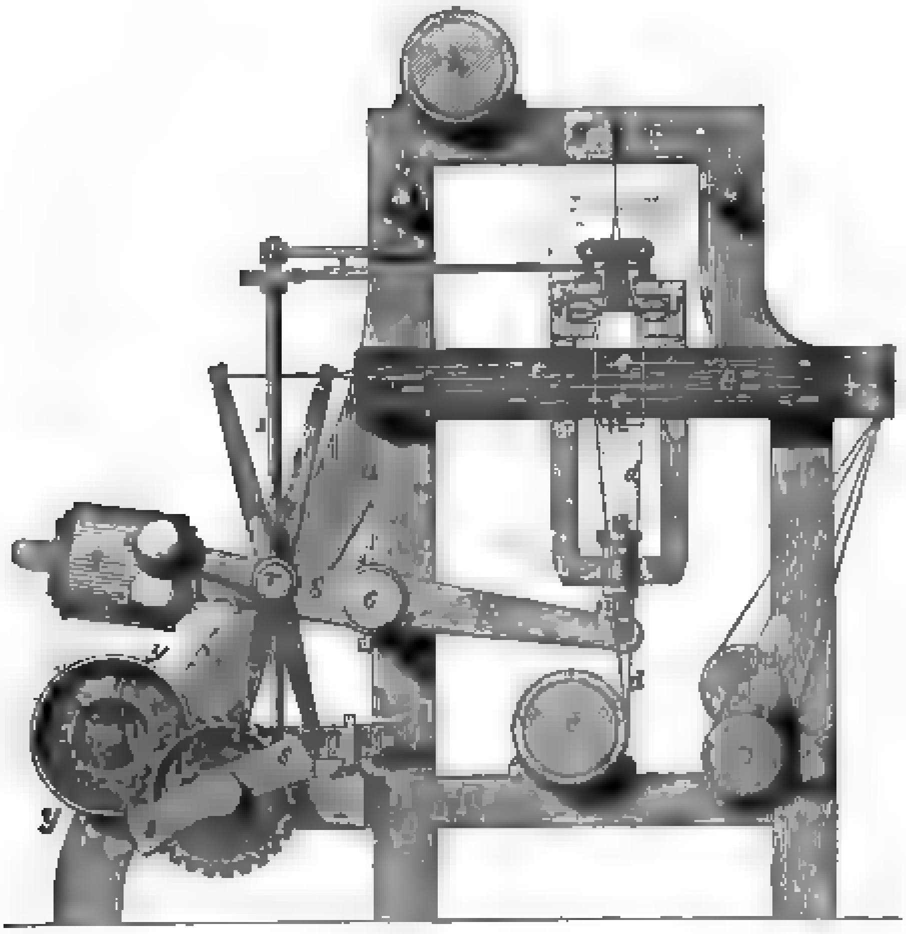


Fig. 183.



wheels *q*, is keyed fast upon the tappet shaft *r r*, upon which the the tappets or cams *s s s*, are also mounted ; thus it will be seen, that as this tappet shaft *r r*, revolves, the tappets *s s s*, will successively actuate the treadle levers *t t*, and divide the warp threads by shedding the headles at proper intervals for the passage of the shuttle *u u* (Fig. 181.) The shuttle is projected across the loom by means of the picker stick *v*, which is suddenly actuated by the spring *w*, causing the roller (see Fig. 181) upon the end of the short lever *x*, to escape the step or fall cut upon the scroll cam *y*, keyed fast upon the cam shaft *p p*.

It will be seen that there is one of these scroll cams at each end of the cam shaft, having the step or fall cut in opposite points of their peripheries, in order to effect the projection of the shuttle from each side of the loom alternately, which will be readily understood by persons conversant with the ordinary evolutions of power looms.

The extreme end of the picking stick *v*, bears against the sliding piece *z*, and exactly at the point opposite the centre line or point of the shuttle, so that the shuttle will thus receive a blow in a direct line through the shed, instead of being liable to that uncertain course sometimes produced when the slide piece *z*, is attached to the picking stick by a cord. Near the end of the picking stick is attached a link 1 (see Fig. 181) connected to the lever 2, fast upon

the upper end of the vertical rod 3; which lever 2, is placed in an opposite direction to the lever x, fast at the lower end of this rod. By these means the picking stick is suitably actuated by the rotation of the scroll cam y: the vertical rod 3, is also visible in Figs. 180 and 182.

The sudden rise of the lay j, and the necessary sharp blow which is desirable to beat up the cloth, as each weft thread is put in, is effected by the cams 4, 4, which are fast upon the shaft $p\,p$, and consequently revolve with it, actuating the lever 5, fast upon the cross shaft 6, and allowing this lever to escape or fall past the straight side of the cam, as will be clearly seen in Fig. 183, where the lever 5, is shown just upon the point of escaping the cam b, and is drawn in dotted lines in the same figure as having escaped this point.

By the momentum of the falling weights 7, 7, at the ends of the levers 8, 8, (fast upon the cross shaft 6, as in Fig. 183) the levers $g\,g$, (also made fast upon the shaft $p\,p$,) are made to rise, and as the frames 10, 10, carrying the lay j, are attached to the extreme ends of these levers $g\,g$, the lay (see Figs. 181 and 183) will immediately ascend with a sharp quick stroke, and thus perform the beating up of the weft thread.

It will be seen that these frames 10, 10, (as there is one to carry each end of the lay) are provided with adjustable stop pieces or set screws 11, (see Figs. 180 and 183) so that the stroke of the lay or degree of impetus may be varied to suit the kind of texture to be produced. As the lay ascends, all the strain upon the warp threads is obviated by means of the india rubber or other elastic bed 12, (see Figs. 181 and 183) with which each side of the loom is provided, for the purpose of giving a slight rebound to the lay, as the stops 11, strike against the bed 12, and thus preventing any possibility of breaking the warps in consequence of the sharpness of the blow given by the lay. It will also be perceived that the degree of impetus given to the lay may likewise be adjusted by sliding the weights 7, upon the levers 8, 8, as occasion may require.

As the blow of the lay against the weft thread is quite sufficient to cause the yarn beam to give out the quantity of warp required, consequently, the taking-up motion which is usually attached to power looms may be dispensed with, merely keeping the whole in proper tension by means of the friction band or weighted cord 13, conducted over suitable tension pulleys 14, 14, and round the drums at the ends of the warp and cloth rollers (see Fig. 180.)

In case the shuttle should not enter the shuttle box at every stroke of the picking stick, the notched lever 15, will catch upon

the tooth or nib 16, (see Figs. 180 and 181) upon the lay as it rises, and thereby raise the lever 17, and by the agency of the rod 18, lift the hand lever 19, off the pin fixed in the side of the setting-on rod *n n*, which will cause the spring 20, (see Fig. 180) to throw the driving pulley *l*, (see Fig. 181) out of gear with the pinion *m*, and thus the loom will be stopped.

The most curious feature in Mr. Fletcher's loom is, in having the *shuttle boxes detached from the lay, and fixed or made stationary upon the framing of the loom, or outside the loom, so that when the warps are divided, the blow from the picker staff can instantaneously be given to the shuttle, which is at rest, and as such blow may thus be given in a direct line with the points or centre of the shuttle, the shuttle will be impelled through the warps in a straight undeviating line, instead of being liable to that zig-zag course so frequent in common power looms, caused by the direct impetus given to one side of the shuttle, and while it is in a state of constant motion with the vibration of the lay, thus frequently throwing the shuttle out of its direct course, causing it to break through the warps and fly out of the loom.*

This machine is highly creditable to the mechanical skill of the inventor; and although the idea of placing the warp vertically in a power loom did not originate with Mr. Fletcher, yet we think his method of effecting this object is decidedly the most practical for the manufacture of plain textures of any hitherto introduced: it admits, however, of still further improvement, and might, in skillful hands, be turned to good account.

The working of a series of shuttle boxes disconnected from the lay and fixed on the framing of the machine, or outside of it, *is not new*, it having been introduced, from *Persia*, into France, about 15 years ago, by M. Eugene Gigot, an antiquarian, of Mulhausen; and since then various modifications of it have been patented in Great Britain and America. Messrs. John and Arch'd Reid, of Glasgow, adapted the detached shuttle boxes to their *vertical* power loom; for which loom they obtained a patent in 1835. In France, the detached shuttle boxes have received the cognomen of the "squirrel cage." It would appear, from the oration delivered before the Median monarch, King Deioces (see Introduction) that Arphaxad was well acquainted with the principle of the rotary detached shuttle boxes, and those procured, in the East, by M. Gigot, are doubtless of the invention of that ancient and ingenious *manufacturer*.

Mr. Fletcher's shuttle motion, shown in Fig. 181, is a very pow-

erful one; and we think it might be used with advantage on looms for weaving wide textures.

Messrs. John Ramsbottom and Richard Holl, of Todmorden, Lancashire, obtained a patent in July, 1834, for certain improvements in the construction of power looms, by which two pieces of cloth may be produced at once. In their loom, the warp-threads are placed vertically in two ranges, one range extending from a yarn beam below to the cloth roller at top in the front of the loom, and the other range extending similarly at the back of the loom. The patent for this machine was purchased by Messrs. Cousins, Diggles & Co., manufacturers and machinists, Bury, Lancashire, (where we saw the loom,) for the sum of £200, sterling. After a short trial, it was found not to answer the expectations of the purchasers, whereupon they returned it to its original owners. This same company paid us a handsome sum, in the year 1836, for an improvement upon a power loom for weaving muslin, and other light textures; which, we are happy to say has met their most sanguine anticipations: we sold the Scotch and French patents for the same invention to John Chanter, Esq., of Stamford st., Blackfriars, London.

George Clarke, of Manchester, manufacturer, obtained a patent in January, 1840, for improvements in the construction of looms, by means of which patterns of considerable extent may be produced on the cloth. This invention may be said to consist, firstly, in a peculiar arrangement of mechanism, forming an endless and flexible rack of teeth or tappets, to be employed in looms, in place of the ordinary revolving tappet-plates or wheels; and secondly, in the application and use of such apparatus, in combination with certain other arrangements of mechanism.

The variety of patterns is obtained by a greater extent of operations being afforded to such working parts of the loom as are required to shift the headles, for shedding the warps, in order to work or produce the pattern or figure, *without the assistance* of the Jacquard machine.

This mechanism, which may be readily applied to fancy looms, is so constructed, that a great variety of shifts, changes, or "numbers to the round," may be accomplished, before it becomes necessary to repeat the order of shedding or recommencing the same pattern or figure, by renewing the "round" (as it is termed by the weaver) and any required alteration in the figure to be produced, may be made with facility and speed; that is, the "reading on" of the tappets or teeth may be varied to a much greater extent, than can be commonly done by the ordinary tappet wheels.

It should here be remarked, that endless chains or ladders have been heretofore employed, for the purpose of changing or shedding the warps, but they are constructed so as to carry rollers, revolving on certain bars, as their axles, and adjustable, longitudinally in their situation thereon ; which rollers act upon certain vertical levers, and thereby effect the shedding of the warps.

But Mr. Clarke's flexible tappet rack, is formed by simply providing a given number of bars or ribs of a certain length, according to the number of shafts or headles employed in the loom, or the width they occupy, and placing them at certain distances apart. Upon these bars are mounted, in any convenient manner, teeth, tappets, or studs, capable of being readily adjusted, as the different patterns or devices to be woven may require ; the whole are formed into an endless flexible rack or band of tappets, by side bands, belts, or chains, hereafter more particularly detailed.

In order that this invention may be more perfectly understood, two modes of applying the improvements are shown in the figures.

Fig. 184.

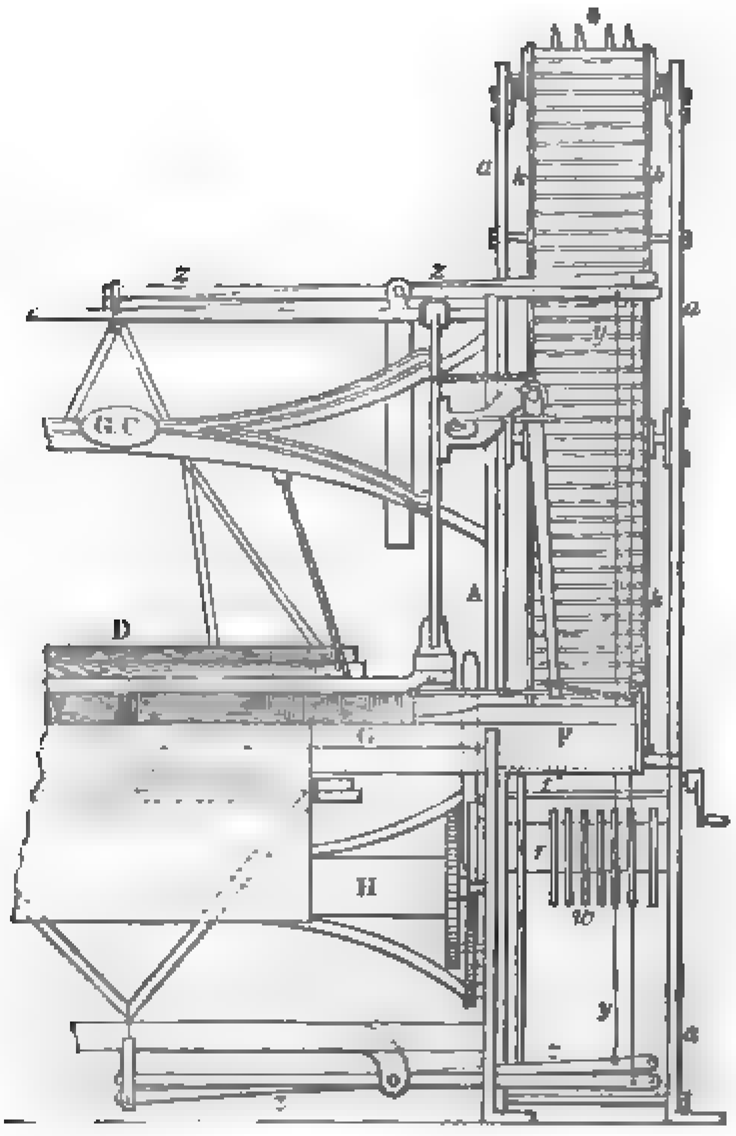
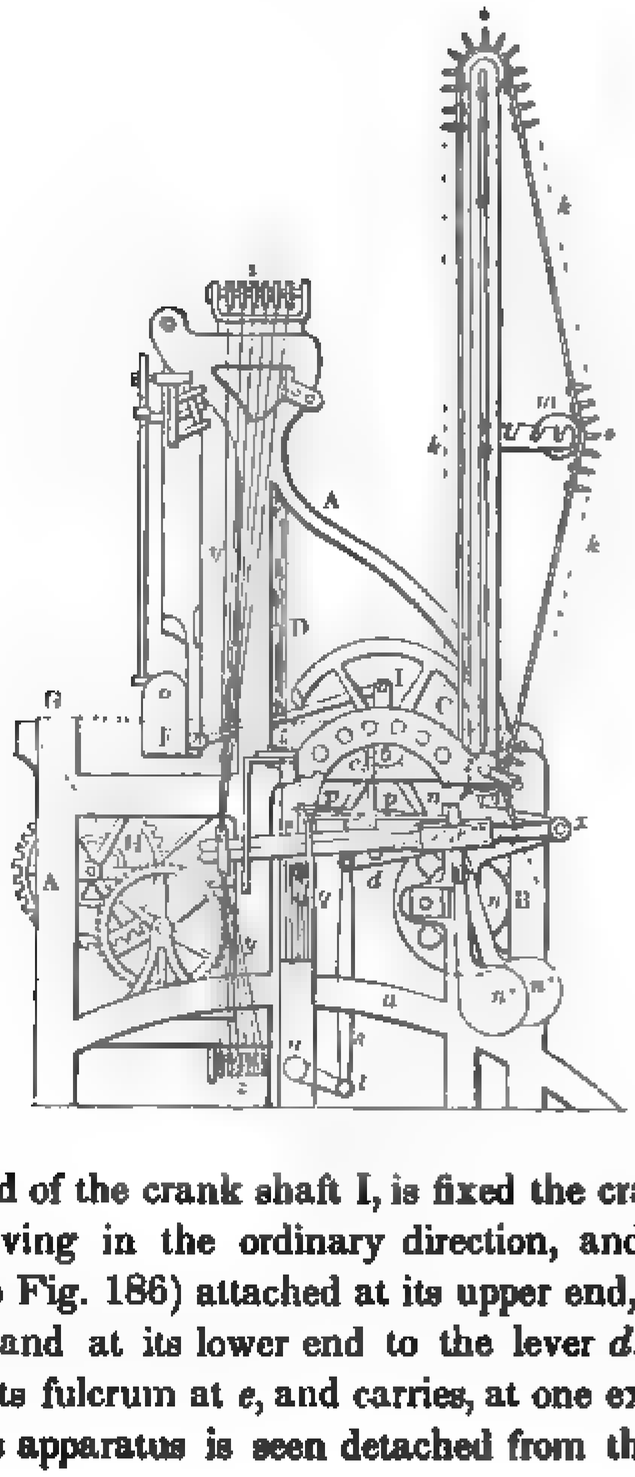


Fig. 184, is a front view of a power loom, representing the application of one description or arrangement of the improved endless belt or chain of tappets to a loom for weaving figured fustians; and Fig. 185, is a side elevation of the same. The ordinary framing or loom-sides, are shown at A A, supporting the warp roller B, from whence the warp threads C, proceed through the headles D, also through the reed E, (see Fig. 184) of the vibrating lay F, (Fig. 185) over the breast beam G, to the cloth roller H, as usual. The ordinary crank shaft of the loom is shown at I, from which motion is communicated to the improved mechanism, attached to the side of the loom, and supported in a separate framing *a a*, as follows:—

Fig. 185.



Upon the end of the crank shaft I, is fixed the crank plate *b*, (see Fig. 185) revolving in the ordinary direction, and actuating the link *c*, (see also Fig. 186) attached at its upper end, by a pin, to the crank plate *b*, and at its lower end to the lever *d*. This lever *d*, vibrates upon its fulcrum at *e*, and carries, at one extremity, a draw catch *f*. This apparatus is seen detached from the loom in Fig.

186, and is designed for the purpose of actuating the catch-wheel *g*, one tooth at every revolution of the crank shaft *b*; the catch-wheel *g*, is mounted upon the shaft *h*, (see Fig. 187) and upon this shaft, the notched guide-wheels *i i*, are also fixed; around and taking into which, the flexible rack or belt of tappets *k k k*, passes (see Fig. 184.) A detached view of the guide-wheels *i i*, catch-wheel *g*, and shaft *h*, is shown at Fig. 187.

Fig. 186.

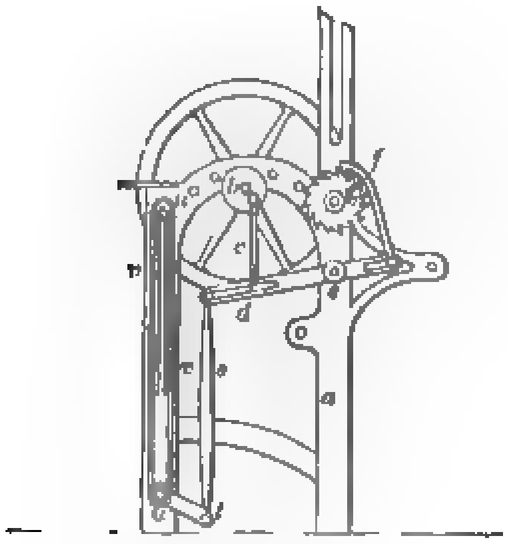
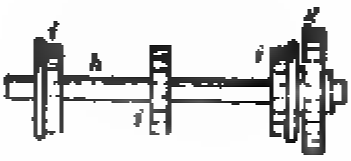


Fig. 187.



The tension pulley *m*, placed about midway in the frame, is for the purpose of assisting the drag or weight of the tappet-rack.

It will now be seen, that as the travelling tappet-rack proceeds, the teeth, studs, or tappets * *, of which it is partly composed, (and which it will be evident to the practical weaver, are so placed, arranged, or "read on," according to the pattern or device to be woven,) will strike against the heads of the headle levers *n n*, (see Fig. 185) with one of which, each headle D, is in connexion. These levers *n n*, are all suspended, and vibrate upon the shaft or fulcrum *o*, (see Fig. 185) and are each connected by means of links or wires *p p*, to the hooked lifters *q q q*, for the purpose of throwing the lifters into the position, where they may be acted upon by the rising cross-bar *r*.

The requisite action of the rising and falling bars *r*, *r**, (see Fig. 184) is effected, simultaneous, with the progressive motion of the tappet-rack *k k*, also by means of the link *c*, vibrating the lever *d*; on the other extremity of which, the connecting lever *s*, is attached, (see Figs. 185 and 186) which is jointed at its lower end, to the crank *t*, fixed upon the roller *u*, around which a strap or belt *v v*, (see Fig. 186) passes, and over a similar roller *u*, at top. To this strap *v*, the bars *r*, *r**, are fixed; and it will be seen, that as the

strap traverses, by means of the vibrating action imparted to the crank *b*, on the end of the crank shaft I, the requisite alternate raising and depressing of these bars is accomplished; they are kept in parallel positions, by traversing up and down in mortices, in the frame *a a*. The headle levers *n n*, are also brought into the position, where they may be acted upon by the falling bar r^*, by means of the weight n^*, with which each lever is furnished (see Fig. 185.)

The hooked lifters *q q*, are each separately connected by a pin to vibrating treadles *w w*, working on their fulcrum shaft *x*, fixed to the frame *a*. These treadles *w w*, are connected at their extremities, by means of the wires *y y*, (see Fig. 184) to the ordinary top and bottom jacks *z z*, and, by the customary stringing, to the headles D, and thus, as the tappet-belt or rack revolves, will shed the warp, and consequently work the pattern.

Fig. 188.

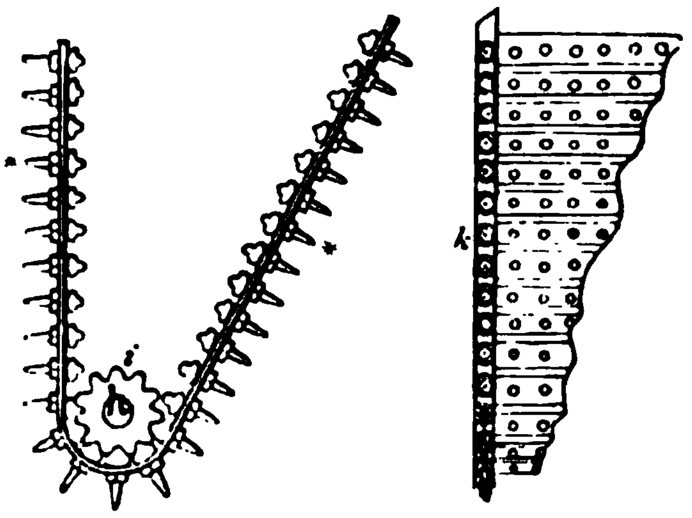


Fig. 189.

Fig. 188, represents a portion of the tappet-rack detached, upon an enlarged scale, and Fig. 189, the several pieces of which the improved endless tappet-rack is composed. 1, shows a front view, and 2, a back view, of the perforated bar, for receiving the studs, teeth, or tappets 2;—3, the nut, by which the tappets are held, and adjustable in the bar. A number of these bars, placed at suitable distances apart, and furnished with the necessary number of holes for "reading on" the tappet-studs, as the pattern requires, are formed into an endless rack, belt, or chain, by being screwed or otherwise fixed upon a band, composed of canvas, tape, and leather, cemented together by means of a solution of caoutchouc.

At Fig. 190, a modification of the improvements, and the mode of applying the same to fancy looms, is shown. The drawing re-

presents a partial sectional view of the figuring apparatus, attached to an ordinary loom side. An endless belt, or rack of teeth, studs, or tappets *a a a*, passes around, and is progressively actuated by the grooved rollers *b b b*, supported in the framing *c c c*, attached to the side of the loom.

Fig. 190.

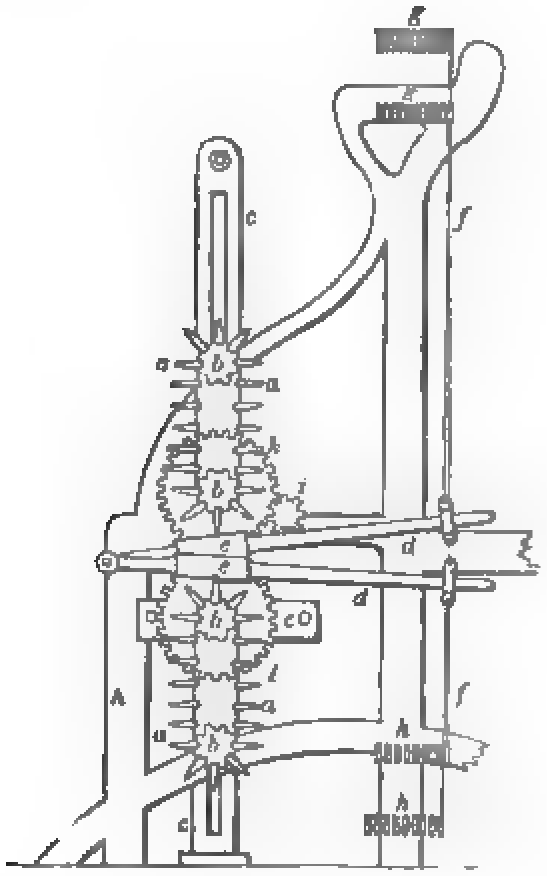
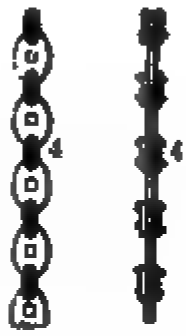


Fig. 191.



The moveable tappets, or teeth *a a a*, are suitably arranged upon their bars or rails, (as in the former instance,) to work the pattern or device required, and are alternately caused to raise or depress the treadles *d d*, successively, by acting upon the rollers *e e*, with which they are provided. Thus the simple action of these risers and fallers is transmitted directly to the headles, by means of the connecting wire *f f*, actuating the top jacks *g g*, and bottom jacks *h h*, which are connected by stringing to the headles, as usual, the whole being put in motion by means of the spur-pinion *i*, upon the end of the ordinary crank-shaft, driving the spur-wheels *k*, and *l*, upon the axles of the grooved or fluted rollers *b b*.

The bars or rails of tappets are connected together at suitable distances into an endless chain, by being confined or strung together by the chain 4, 4, shown at Fig. 191, at each side, or by any other suitable means; thus it will be seen, that these studs or teeth, and their intervening blanks or spaces, may be so arranged, upon any bar, or system of bars, that the necessary raising and depressing of

the treadles *d d*, may be varied or adjusted, to suit the pattern or device required to be woven; which arrangement, adjustment, or "reading on" of the tappets or teeth, in both the above descriptions of racks, belts, or chains, will be readily understood, and applied by the practical weaver.

This improved loom of Mr. Clarke's, is, no doubt, the best hitherto introduced for weaving fancy goods, and, in our opinion, it is worthy the attention of manufacturers of such textures. Various other contrivances for working a series of headles have been invented, by different individuals, but none of them are equal, in point of practical utility, to Mr. Clarke's. We shall, however, briefly notice a few of those which are likely to prove interesting, for the *benefit* of manufacturers who *live in the country*.

Mr. Robert Bowman, of Manchester, obtained a patent in January, 1821, for improvements on the power loom, enabling him to work six leaves of headles; which headles are suspended by cords from the ends of a set of top levers, and are also attached to another set of levers or treadles underneath. The movement for raising and depressing the headles is obtained by means of two sets of tappet wheels, each set having as many tappets as there are headles. These tappet wheels are fixed, one set above and the other below, and are turned by means of a pinion upon the end of the crank or driving shaft.

Mr. Richard Roberts, of the firm of Sharp, Roberts & Co., Manchester, obtained a patent in November, 1822, for a tappet wheel; but as it does not differ in principle from Mr. Bowman's, it is unnecessary to describe it.

John Potter, Esq., of Smedly, near Manchester, obtained a patent in May, 1825, for an improvement in power looms, for weaving various kinds of fancy goods; which improvement consists, in working a number of headle-leaves by means of two series of levers, attached to the side of the loom, one series at top and the other at bottom; and as these levers rise and fall, the headles are moved up and down, for the purpose of shedding the warp. The apparatus by which the levers are actuated, is similar to the common barrel organ, and does not differ, in any respect, from that used by Mr. Fairman, in his loom, shown at Figs. 175, 176, and 176½; the levers and cords which connect and work the headles at top and bottom are also the same as those employed by Mr. F.

Joseph Jones, of Oldham, Lancaster, cotton manufacturer, and Thomas Mellowdew, of the same place, mechanic, obtained a patent, June 16th, 1834, for improvements in the construction of

power looms, adapted to the manufacture of corded fustians, and which improvements consist, in the adaptation of an endless chain of plates, or links, to the common power loom, so constructed as to govern the position of the headles, according to the kind of cord, or diagonal stripe to be produced on the cloth. The principle of this improvement is the same as that of Mr. Clarke's invention, represented at Figs. 184, 185, 186, 187, 188, 189, 190 and 191; which precludes the necessity of a more detailed description.

Enoch Burt, Oliver D. Boyd, and Amos H. Boyd, of Manchester, Conn., obtained a patent 19th August, 1828, for what they term, "an improvement in the check or plaid power loom;" which improvement consists, firstly, in fixing a wheel, about 8 inches in diameter, to the side of a common power loom, upon the periphery of which wheel, at right angles with its plane, are constructed as many shuttle boxes as there are colours in the check or plaid to be woven. On the backside of this wheel, is a small toothed wheel which is turned forward and backward, by means of two arcs of a circle, or segments of a wheel, on the ends of two levers, moving on a stud as their common fulcrum. One of these arcs or segments is toothed on the outside and the other on the inside, embracing between them the before named small toothed wheel. A power acting in the same direction, alternately on the other end of the said levers causes the shuttle boxes to move forward and backward, bringing each shuttle box, in turn, to a proper position for discharging its shuttle through the shed and receiving it again from a box of the ordinary kind on the opposite end of the lay. These shuttle boxes, containing each a shuttle, are shifted to form the check or plaid in the following manner :—

A wheel, containing one-half the number of teeth which the complete check or plaid to be woven contains threads, is placed on a stud-pin, round which it revolves, at right angles with the lower end of the levers, on the top of which are the toothed arcs or segments. This wheel is moved a tooth at every second stroke of the lay, by means of a short arm on the cam shaft of the loom: on the plane of this wheel is affixed two cam plates, whose respective extremities are met by the respective extremities of the two before named levers, as the lay moves forward to beat up the thread. The extremities of the cam plates are indented and protruded alternately as the figure to be woven requires; and when the wheel to which the cam plates are attached performs one complete revolution, the shuttles will have shifted through all the variety of the check or plaid and be prepared to commence the same routine again, without

interrupting the motion of the loom. At every shift of the shuttle boxes, a spring arm drops into a cavity or notch in the edge of the plane wheel on which the shuttle boxes are fixed, by which they are prevented from moving until required again to shift; at which time, the spring arm is raised out of the cavity or notch, by means of a spring fastened at one end of the cam plates, with an inclined plane on the other end, which is acted upon by the lower ends of the levers that move the boxes, before they strike the edges of the cam plates.

The shuttle is thrown from the fixed box to the moveable one by a picker of the ordinary kind, but from the shifting boxes to the fixed one by a picker lying horizontally, the end of which enters into a slot or opening in the backside of the moveable boxes. The loom protects, in case the shuttle fails to box, in the ordinary way, each of the shifting boxes being furnished with a guard, like that in the fixed box, which acts in turn upon the finger on the protection rod.

To secure a correct check or plaid, the loom is made to stop in case the weft thread breaks, or has become expended on the bobbin. On the crank shaft, near the selvage of the cloth, is placed a cam with a concentral offset on one side, to which an arm, hung on a stud, presents its extremity when it is to stop the loom, but at other times lies below it. This arm is raised by every revolution of the cam, so as to be in a position to meet its offset, and is held in that position by a delicate spring catch at the other end of the arm. As the shuttle enters the box, if the thread from the bobbin in the shuttle be entire, it will extend from the edge of the web to the shuttle box; between these there is a small aperture in the reed, or at its end, through which a small horizontal slide will project a little when the lay is fully down; across this aperture and in front of the end of the slider, the thread will lie, (if unbroken,) where it is *held fast by a cramp that falls upon it*, and is pressed down by a spring as the shuttle enters the box, and which is thrown back as the shuttle leaves the box. When the lay moves forward, the thread, thus extended across the aperture and held fast, forces back a little the horizontal slider, which instantly unlocks the before named spring catch, letting the point of the lever or arm fall below the offset in the cam; but if there be no weft thread across the aperture, the slide passes through without being driven back, consequently the arm remains locked and instantly stops the loom.

Before closing our observations on looms for weaving fancy textures, we shall offer a few remarks on the manufacture of several

kinds of silk textures, by hand, but which may also be found applicable to power loom weaving, comprising taffetas, gros de Naples, satins, &c., hoping that they may be of service to those of our friends who are not much skilled in silk manufactures.

TAFFETAS.

Taffetas should be woven with the warp pretty tight; and as soon as the shuttle is passed through, the shed is to be closed, just before the stroke of the reed is given. This manner of closing the shed before beating up the weft thread, causes a better grain to be given to the cloth. On this kind of texture, the temples must not at any time be at a greater distance from the reed than 2 inches, before changing them, to avoid making a thin place or shire in the fabric. The weaver must give the strokes of the reed with uniform force. Superior taffeta is made with 4 threads per dent of the reed, and inferior with 3 threads per dent.

SHINING TAFFETA.

Shining taffeta is more brilliant than that just noticed; and is made with a warp *less light.* The stroke of the reed is given when the shed is nearly full open; which renders the cloth very brilliant in appearance, and does not make it *dry* and *stiff:* what makes it supple, is that the warp is *slacker than in other taffetas.* In weaving this fabric great care must be taken that *the weft threads be laid evenly together*, (for more than one thread is generally used,) and when the shuttle is passed through the shed, the weaver must see that the thread from the shuttle lies properly, neither too tight nor too slack. Care must also be taken that the weft thread be always delivered from the shuttle with perfect uniformity of tension; otherwise, there will be *ins* and *outs* in the selvages, giving the edges the appearance of a *carpenter's saw.* The *French* are very particular, indeed, in attending to these matters, which is the principal reason why their goods always feel so *smooth* and *soft* to the touch. The great *secret* in manufacturing these silk textures, is to make the *greatest possible show with the least expense of material.*

GROS DE NAPLES.

Gros de Naples is woven with the warp pretty tight in the loom, that the silk may more easily disengage itself when the shed is being opened; and the weft must be well struck up. There must be

two strokes for each passage of the shuttle, the first with open shed and the second with close shed: if only one stroke were given to each crossing of the weft thread, it would have to be given with greater force; but then the fabric would not be so good; whereas, in giving two moderate strokes, the cloth will be perfectly even. Clean white paper must be put on the cloth roller, as fast as the fabric is wound on; because this texture having a thick warp and weft might become watered by the vibration given to that roller by the stroke of the reed.* Gros de Naples is made with double and treble threads in the warp, and with 4 threads in the dent of the reed. The weft is composed of 3 or 4 ends put together, or according to the thickness of the cord wanted in the fabric: for fine gros de Naples, there are of course, fewer ends used in the weft, but 4 ends is the number generally employed. In weaving gros de Naples of inferior quality, one stroke of the reed, only, is given to each thread of weft: but when the quality is to be superior, two strokes are indispensable, in *hand looms.* Since the introduction of the new mechanism, invented by C. G. Gilroy (see Section Twelfth) to the power loom, in combination with Jacquard machinery, not only these fabrics, but all fabrics, of silk, or of other materials, generally, can be manufactured with the greatest facility and profit. These improved looms have received the approbation of the most skillful manufacturers of England, Ireland, Scotland, France, Belgium and Prussia. (See testimonials at the end of Section Twelfth.)

THICK SILK CLOTH.

Thick silk cloth is a fabric made with 4 threads, *double* or *treble*, in the dent of the reed, according to the quality; and it is generally manufactured in a loom with 8 or 10 leaves of headles, half of which are raised and depressed alternately. The reason for using so many headles on plain texture, is to prevent the warp from being crowded in the headles. The warp is not kept tight in the loom, particularly when it is wanted to cover well. The pace weights which govern the tightness of the warp, must be moveable, and there should be one weight on each side of the beam or roller, so as to strain equally. There must be a whip roller, turning on gud-

* We have laboured 15 years, in France and Great Britain, to produce as perfect silk and other goods, plain, tweeled and figured, in the power loom, as could be effected by the most skillful weaver, by hand; and how well we have succeeded, our friends will be better able to judge after reading the proofs set before them in next section.

geons or journals, placed at a proper height to suit the headles; and over this roller the rope must be passed (see Figs. 219 and 220;) which roller will roll with the silk as fast as the cloth is taken up on the cloth roller and prevent the evil effects which would be continually caused by the decreasing diameter of the warp beam.

It requires a very skillful weaver to make a good silk fabric, and even in France the manufacturer is often at a loss for competent workmen; some who have worked at this business for 30 or 40 years, not having paid sufficient attention *have not become good weavers;* while others have obtained ten times the amount of knowledge in one-fifth of the time.

The weft thread repeats 4 times in the middle of the selvage (in this kind of texture) and only twice in the edges: the selvages work in opposition to each other, that is to say, when one selvage is opened on the right the other is closed on the left, and vice versa. This prevents the weft thread from following the shuttle back again. A piece of silk goods is never considered well woven unless the selvage is perfect in every respect, and entirely free from hills and hollows on the outer edge.

SATIN.

Satin is made of different widths, from $\frac{3}{4}$ths to $\frac{3}{8}$ths of an aune (44 inches, French) and of various lengths of web; and has from four threads to ten threads per dent in the reed. When only four threads are entered per dent, only five leaves of headles are used; which headles are made of raw silk.

This kind of fabric is dyed after it is woven, and is used only for making hats and artificial flowers. Black satin is generally made with a double warp, when intended for making the crowns of hats, caps, &c. The sleeking tool is used for all satins, except those of 4 threads per dent of the reed; to these a soft brush is applied instead. Three or four dents at the edges of the cloth are gros de Tour (same as selvages of gros de Naples.) Sometimes the selvages to satin fabrics are zig-zag in the middle and the rest gros de Tour.

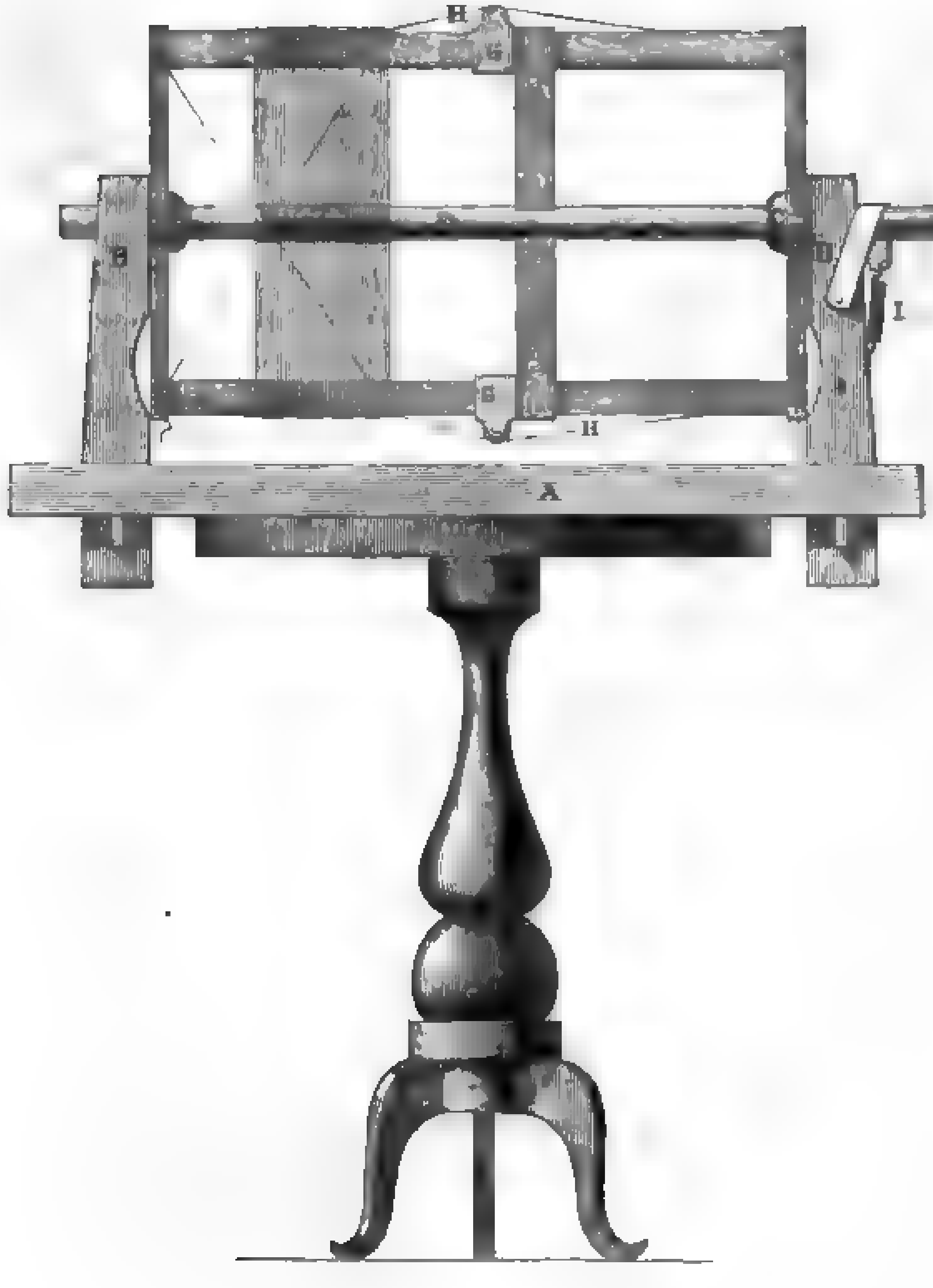
In weaving a superior satin, the warp must not be too tight; and it must be worked with an open stroke, so that the weft may be perfectly tight and straight. The warp must be well *picked* before being put into the loom, *by a Lyons silk picker;* or else it will be impossible to make a fine satin.* For these kinds of textures, the headles should be 16 inches in depth.

* A Lyons silk warp picker, or cleaner, costs 1600 francs; and may be procured on application to M. Dioudonnat, No. 12, Rue St. Maur, Paris.

HEADLE-MAKING MACHINE.

John Blackmar, of Brooklyn, county of Windham, Conn., obtained a patent for a machine for making headles, bearing date October 20th, 1836; a representation of which machine is given at Fig. 192.

Fig. 192.



The patentee observes, that "this machine may be constructed in all essential respects like those now in common use, excepting the application of that principle which makes a part of the machine a

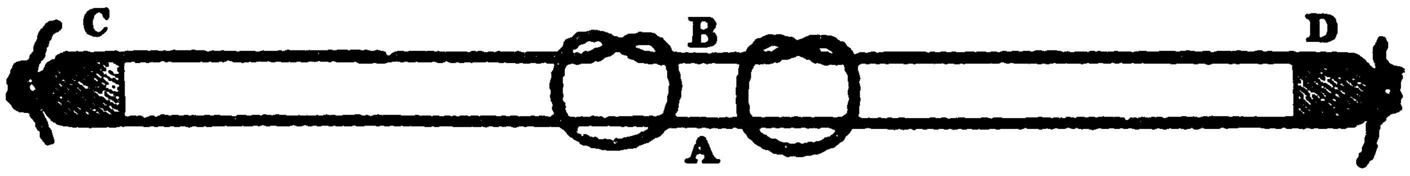
bench susceptible of a rotary or revolving motion." This is effected in the following manner:—

A, Fig. 192, represents the bottom of the machine or bench; B B, side posts, carrying the shaft D, having suitable gudgeons C C, at its ends: these gudgeons C C, pass through the end pieces E E, and these end pieces are made fast on the gudgeons C C; F F, side pieces of the frame on which the headles are constructed; J J, brace to hold the shaft D, and the side pieces in their proper places to keep them from sagging; G G, slide-stands, each carrying a small pulley over which the muddling twine or binder H H, passes: the slide-stands G G, may be shifted by the operator to any position best suited to facilitate the work; I, spiral spring, for the purpose of holding the shaft D, in any desired position.

Mr. Blackmar claims as of his invention the revolving principle of the headle frame; whether constructed in the way described or in any other way. It is curious that a patent should have been granted for a revolving headle-frame so late as the year 1836, when it has been well known, and, in fact, the only machine used for making headles in Lyons, Paris, Rouen, and many other manufacturing places in France these 30 years past, and has been of late introduced (from France) into Spitalfields. It cannot, therefore, be the subject of a valid patent in the United States of America; yet Mr. B. possibly may have had no knowledge of its existence elsewhere previous to the date of his patent.

A patent has been secured in America, for a peculiar method of forming the eyes of headles, which consists of a double knot, one

Fig. 192½.



on each side of the eye, as represented in Fig. 192½. The side A, is perfectly straight, whilst two single knots are formed on the side B, each of which encloses the side A, when drawn tight, the eye being formed between the two knots, so that in the up and down motion of the headles, the warp threads are pressed against the knots, which being hard tied, are not so likely to cut the eye as if they pressed against a single loop of the headles. C D, are the headle shafts. This improvement, we think, is a *valuable* one, and well worthy the attention of cotton manufacturers, particularly those of them more immediately engaged in making fine goods.

As these headles are generally made of cotton yarn, they would

soon wear out unless protected by a suitable varnish being rubbed upon them. We shall lay before the reader two methods of doing this; for the first of which we are indebted to Mr. James Montgomery, superintendent of the York factories, Saco, Maine. Mr. M's varnish is made of the following ingredients:—

1 Gallon Linseed Oil,	½ Lib. Umber,
1 Lib. Litharge,	½ do. Gum Shellac,
1 do. Red Lead,	¼ do. Sugar of Lead.

All these, except the shellac, are first well boiled over a moderate fire, until the strength is out of the lead; the shellac is then added, but only a little at a time, while the whole is boiling, and it requires to be well stirred all the time. When the shellac is entirely dissolved, the whole is then cooled down to blood heat, then a sufficient quantity of the spirit of turpentine is added, to make it fit for use. Such articles as require it, are to be pulverised. Before putting on the varnish, the headles should be brushed down with paste or size from the dressing machine: and after the varnish is thoroughly dry and hard, they should be again brushed down with tallow, to smooth them well before they are put into the loom. Headles properly varnished in this manner, and perfectly dried before they are used, will generally last over one year.

This receipt of Mr. Montgomery's is, no doubt, a very good one for common headles, for weaving the coarser descriptions of shirting &c.; indeed, it appears to be the only kind of varnish used for headles in the United States; but for weaving fine goods, such as muslin, &c., the following receipt will be found far superior, as headles varnished on this plan will not *chafe* the warp; and, after 5 or 6 days working, on either power or hand looms, will become as smooth as glass.

Varnish for Headles.—2 gallons linseed oil, boil slowly 1¼ hours; then add 32 ounces gum shellac, boil 20 minutes, then add 32 ounces red lead, boil 20 minutes; then add 16 ounces umber, boil 20 minutes. This done, take the varnish off the fire, and add 2 gallons spirit of turpentine: the varnish must not be very hot when the turpentine is added, to prevent it from taking fire. In making this varnish, it is to be constantly stirred; and the several ingredients of which it is composed must be added slowly.

Note. In boiling the various ingredients, the manufacturer may use his own judgment as to the time when each of them becomes properly dissolved: but we think the foregoing directions will be found pretty correct.

Application of the Varnish.—In applying this varnish, it must

be mixed with *flour size*, and three coats should be given of the composition thus formed. Make the first coat of 1 part varnish and 3 parts flour; the second, half varnish and half flour; and the third, 3 parts varnish and 1 part flour. Let one coat be dry before putting on another. The headles should be hung up in a warm room while the various coats are drying.

In this receipt we have stated only small quantities of the different ingredients, but as the proportions mentioned are correct, they may easily be increased to any desirable extent. We have used varnish of this kind on the front headles of damask looms for weaving table cloths, piano-forte covers, furniture stuffs, and other descriptions of figured goods, for upwards of 18 years; and we can testify that it is the best composition for this purpose we have ever known: we can, therefore, recommend it, with the utmost confidence, to manufacturers of such fabrics.

TEMPLES.

There is, perhaps, no implement about a loom of greater importance than the temple; for it is through its instrumentality that the cloth, as it is woven, is kept at its proper breadth, while the reed beats up against it. As we have already shown the construction of temples used on hand looms (see L L, Fig. 6, page 75, Section First,) it now only remains to show those best adapted to power looms.

Numerous patents have been obtained in Great Britain, France and America, within the last few years, for improvements on temples, so as to render them more applicable to power loom weaving, by obviating the necessity of shifting them on the cloth, as is required in hand loom weaving. The contrivance which has been found to answer this purpose best, particularly for stout textures, is the "American nipper" or "jaw temple."*

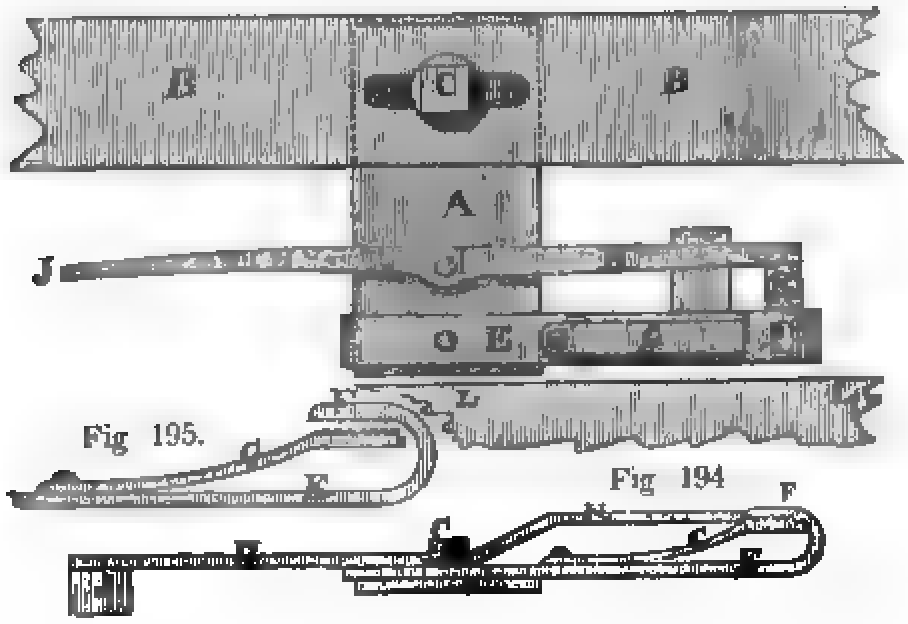
Fig. 193, represents a plan view of the nipper or jaw-temple; Fig. 194, a side or edge view; and Fig. 195, a detached part of Fig. 194, on an enlarged scale.

One of these nippers is to be fixed on the breast beam of the loom, at each selvage of the cloth, where it is acted upon by the motion of the lay, which opens the jaws or chaps of the nippers

* The principle of this temple appears to be the same as that of the temple used by E. K. Arphaxad, on his great vertical weaving engine, invented many thousand years ago. (See Introduction.)

every time the cloth is struck up, and permits the cloth to be slidden forward towards the cloth roller.

Fig. 193.



The plate A, to which the nippers are attached, is to be fixed to the breast beam B B, by means of a screw bolt C, as shown in Figs. 193 and 194. The long slot D, made in the plate A, (Fig. 193) is for the purpose of adjusting the temple to suit different widths of cloth.

At the extremity of the plate A, (Fig. 193,) a bar E, is fixed; which bar is turned-up at one end (see Fig. 194) for the purpose of forming the upper chap F, of the nippers. The under chap G, (Figs. 194 and 195) is a spring-piece, and is pressed against the chap F, by its elasticity. The inner surfaces of the chaps F, and G, are guttered out, like a rasp or coarse file, to enable them better to hold fast the cloth.

The lever H H, (Figs. 193 and 194) turns on the fulcrum-pin I; which pin is fixed in the plate A. At the left end of this lever H H, there is a flattened-out or broad-piece J, (see Fig. 191,) and at the right end a knife-edged wedge-piece K.

The lower part of the front of the lay is partially represented at L L, which, when it moves towards the breast beam to strike up the cloth, comes in contact with the end J, of the lever H H, thereby causing the wedge-piece K, at the other end, (to the right,) to be *forced in between the chaps* F, *and* G; by which means, the cloth is released at the *moment the lay is full up against it;* but whenever the lay retires, the wedge-piece K, *slips back out of the chaps* F, *and* G, and the cloth is again grasped by the temple.

It will now be perceived that the cloth will be released every

time the reed comes in *contact* with it, and grasped again by the chaps or jaws F, and G, the instant that the reed *begins to retire* from it; thus enabling the temple to hold out the cloth to the same width at which the reed held it.

This kind of temple should be so fixed on the breast beam as to enable it to take hold of the selvage within *half an inch of the reed, when the reed is full up against the cloth.* For very stout goods, the chaps or jaws should, if possible, be brought within ⅜ths of an inch of the reed; by which means the cloth will be kept better extended. This temple is certainly a valuable acquisition in power loom weaving, and well worthy the attention of manufacturers generally.

The rotary temple, which is also an *American* invention, was made the subject of a patent in the United States, by Mr. Ira Draper, of Weston, Mass., January 7th, 1816; and the same gentleman obtained a second patent, for improvements thereon, April 1st, 1829. We shall at present turn our attention to Mr. Draper's improved temple.

Mr. Draper remarks, that, as many defects were discovered by subsequent experience in the working of his temple, patented in 1816, they have given rise to the following improvements in its construction.

The wheel with oblique teeth, similar to the first plan, revolving on a centre pivot (like that marked H, Fig. 196) is riveted or screwed into an iron plate (like that marked I, Fig. 196:) this plate has two grooves made in it, to receive two screws, to confine the plate down (see Figs. 196, 197 and 199.) The grooves are calculated to admit of changing the position of the temples, to suit the width of the cloth to be woven, similar to the method patented in 1816.* A metal ring surrounds the wheel and teeth, or the wheel may be altogether of metal, and has a bar across the upper edge, with a hole in its centre having a screw cut in it, by which it is screwed down on the centre pivot. A short angular groove in the upper edge of the ring receives the cloth, and *guides it exactly at the required distance.* A notch being filed or cut in the edge of the ring over which the cloth passes, causes the teeth to leave the cloth freely. For the greater convenience of adjusting the temples, without unscrewing the screws above referred to, a thumb screw is

* As the principle of Mr. Draper's temple is the same as that of the temple represented in Figs. 196, 197, 198 and 199, we think it unnecessary to give drawings of it here.

inserted in a lip projecting from the edge of the ring: the lower end of this thumb screw has a groove turned in it, which plays in a groove in the bottom plate; and, by turning the thumb screw, the rim on the lower end binds on the under side of the bottom plate and confines the ring.

Mr. Draper observes, that one great difficulty in the application of the temples first patented by him, was their being screwed *firm on the breast beam and having no elasticity;* the consequence was, every time the reed struck the weft, the cloth would give way and *recoil*, giving the toothed wheel a *sudden rotative motion, increasing the wear of the temples ten fold and enlarging the holes* made by the teeth in the cloth. In addition to which, if the shuttle, by any accident, should not reach its destination in the lay-box, but should stop a little short, it would be caught *between the reed and temples*, and consequently break either the reed or the shuttle.

To remedy these objections, a spring is substituted long enough to receive the cloth. This spring is screwed by its centre to a suitable stand, inside of the breast beam, and is long enough to suit the width of the cloth, and is placed as near the reed as safety will permit, and the temples being screwed on each end of this spring gives them an opportunity of moving laterally with the cloth, and obviates the sudden rotary motion.

The improvements claimed by Mr. Draper are, first, the *ring with the cross-bar which confines the toothed wheel;* second, the *centre pivot on which the toothed wheel turns;* and, third, the *spring on which the temples are screwed,* instead of being screwed to the breast beam.

William Craig, of Manchester, and John Cochran, of Stockport, have lately obtained patents for improvements on the rotary temple, in England, Ireland, Scotland, and France; their American patent bears date November 25th, 1841.

This improved temple is a remarkably neat piece of mechanism, easily applied to a loom, and not liable to get out of order, and is certainly well calculated for cotton textures generally.

Fig. 196, is a top view of the temple; Fig. 197, a bottom view, as seen from underneath; Fig. 198, an end view, as seen from the side of the loom; and Fig. 199, an edge view, as seen when standing at the back of the loom, looking towards the breast beam on the left side. The temple represented in the Figs. is the right hand one, a similar one being required at the left.

Fig. 196.

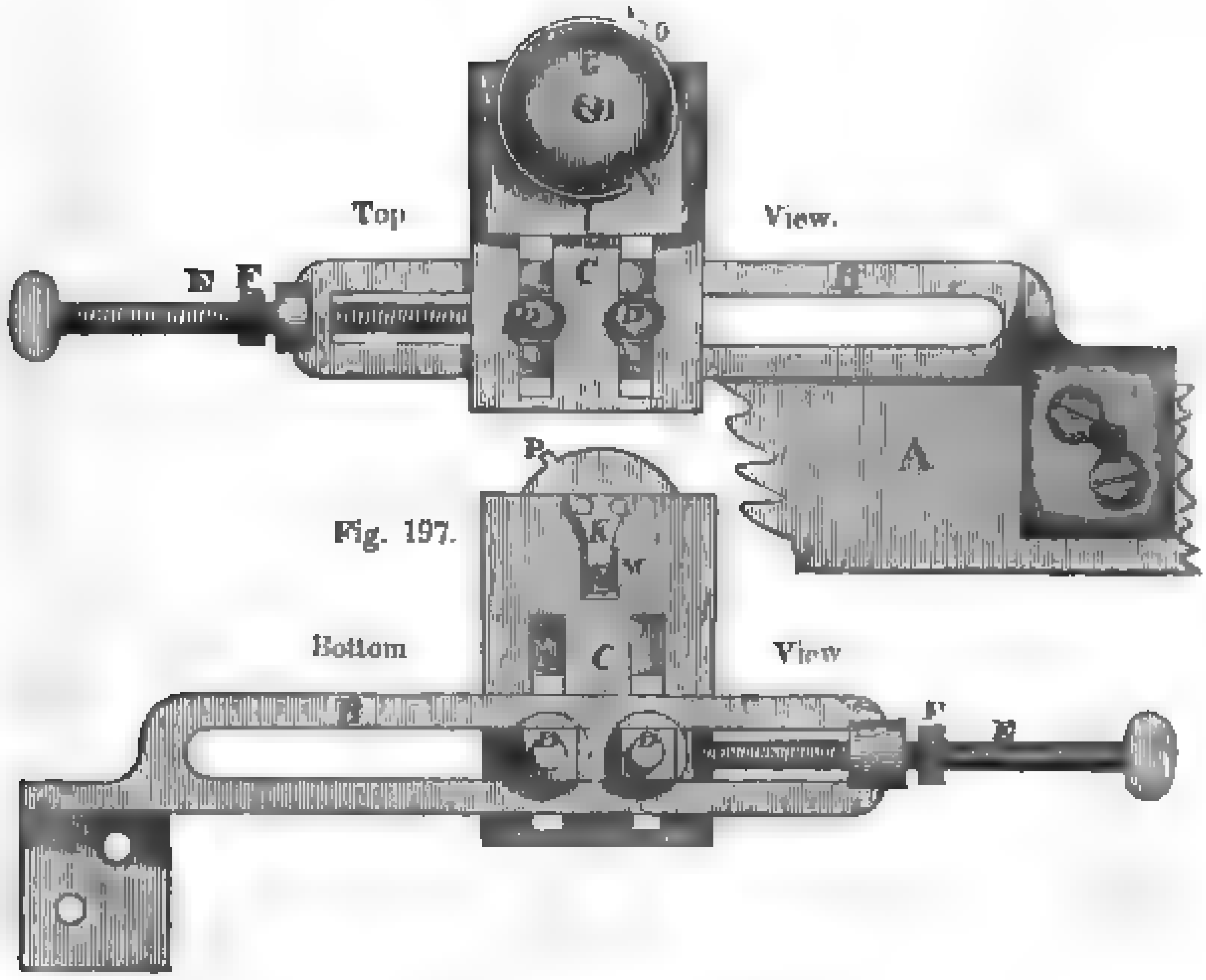


Fig. 197.

Fig. 198.

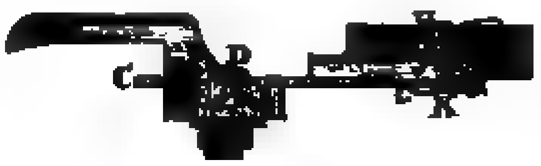
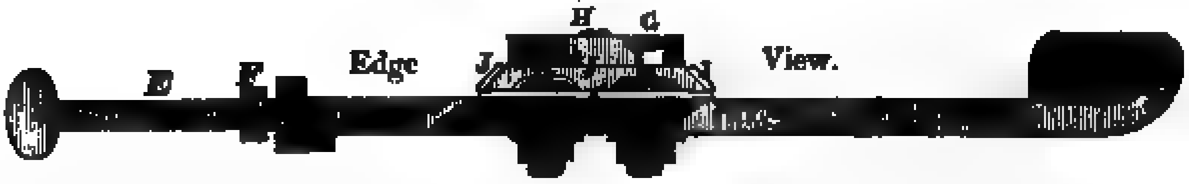


Fig. 199.



A, Fig. 196, Breast beam, on which the temple frame is screwed, by two screws, as shown in the Fig.

B, Frame which carries the temple apparatus.

C, Slotted piece of sheet iron, with turned-up edges J J, for the purpose of holding the plate I, which carries the temple.

D D, Two small bolts to screw down the plate C, on the frame B.

E, Regulating screw, for setting the temple to suit different widths of cloth, and to keep it firm in its place when adjusted.

F, Jam-nut, for holding the regulating screw E, in its proper place.

G, Rotary rim or temple, having teeth round its circumference.

H, Fulcrum or stud pin on which the rim G, revolves.

I, Plate on which the temple is fixed and into which the fulcrum or stud-pin H, is screwed, to hold the temple G, down, but permitting it to rotate freely.

J J, Turned-up edges of the slotted piece C, for the purpose of holding the plate I, on which the temple G, is fixed.

K, Figs. 197 and 198, Small spring screwed or riveted on the under side of the temple, its end being rounded and bent inward, passing through a small slot M, cut in the plate C, as shown in Fig. 197. The rounded point of the spring K, is made to drop into a small notch L, made in the back or under side of the plate I, nearly opposite the centre of the rim or temple G, and is for the purpose of keeping the temple in its proper place *longitudinally:* otherwise, the plate I, on which the temple is fixed, might, in the working of the loom, get jarred out from between the turned-up edges of the slotted piece C.

L, Notch made on the outer side of the plate I.

M, Slot cut in the plate C, to admit the end of the spring K.

N, Point of the temple at which the cloth escapes during the operation of weaving.

O, Point at which the cloth enters.

P, Small projection on the exterior of the wheel box (see Figs. 196 and 197.) The selvage of the cloth is *lapped over* this projection, as it passes from the reed through the opening O, to the points or teeth of the temple G, and from thence through the opening N, to, and over the breast beam to the cloth roller, as usual.

There are two small square pieces of iron fitted in the slot of the frame B, having each a hole made in it to receive one of the bolts D: these square pieces of iron serve to strengthen the sides of the frame B, as well as to screw the slotted plate C, against; and the pieces are not quite so deep as the frame B, into which they are inserted, so that the bolts D D, may bind down the slotted plate C, firmly against the two sides of the frame B, without bending the slotted plate C. The bolts D D, will draw the slotted plate C, gently against the little square pieces, and thus the whole will be secured firmly together.

The temples should be set from the face of the cloth about ½ inch, and in the working of the loom, should the shuttle not reach its destination in the shuttle-box, but come in contact with the outer edge of the temple-box, the reed will drive or slide the temple-box with its plate I, back over the slotted plate C, the spring-catch K, which holds the plate I, being slid out of the notch in the underside of the plate I, by the sudden concussion of the shuttle against the outer edge of the temple, *thereby saving the shuttle and reed from injury.* Whenever this accident occurs, the temple plate I, must be pressed forward into its place by the weaver: but of course, this accident can only happen when the protector fails to operate.

In power loom weaving, when the shuttle fails to enter the box and stops in the shed, the loom should protect far enough back from the cloth: otherwise the reed would come in contact with the shuttle, force it forward against the fell of the cloth, and, perhaps, break 300 or 400 threads of warp: the warp would also be drawn from the yarn beam a length equal to the breadth of the shuttle,

which would cause much delay, independent of the breaking of the threads.

The principal feature of novelty in this modification of the rotary temple is the *projection* P, on the *exterior* of the temple box (as shown in Figs. 196 and 197,) *over* which the selvage of the cloth is *lapped*, as it passes from the reed through the opening O, to the points of the rotary rim or temple G, and from thence through the opening N, as before stated, this projection *turning* the selvage *downwards*, at the proper angle, to be received on the points or teeth of the rotary rim or temple G; and by these means, the *strain* of the cloth is *partly* taken from the temple, the friction thus caused preventing the teeth from drawing *asunder* the threads of the selvage, as is the case with the rotary temples used heretofore.

The teeth of the temple are inserted (as in other rotary temples) in the rim G, at an angle best calculated to hold down the selvage of the cloth, and prevent it escaping from them; and, as nearly all the strain comes on the projection P, the cloth is not so likely to *escape* from the teeth, nor yet to be *torn* or injured by them, as in rotary temples without such a projection.

The other parts of Messrs. Craig and Cochran's temple, shown in the Figs., do not differ from those of Mr. Draper's, except in the neatness of construction.

FORK AND GRID MOTION.

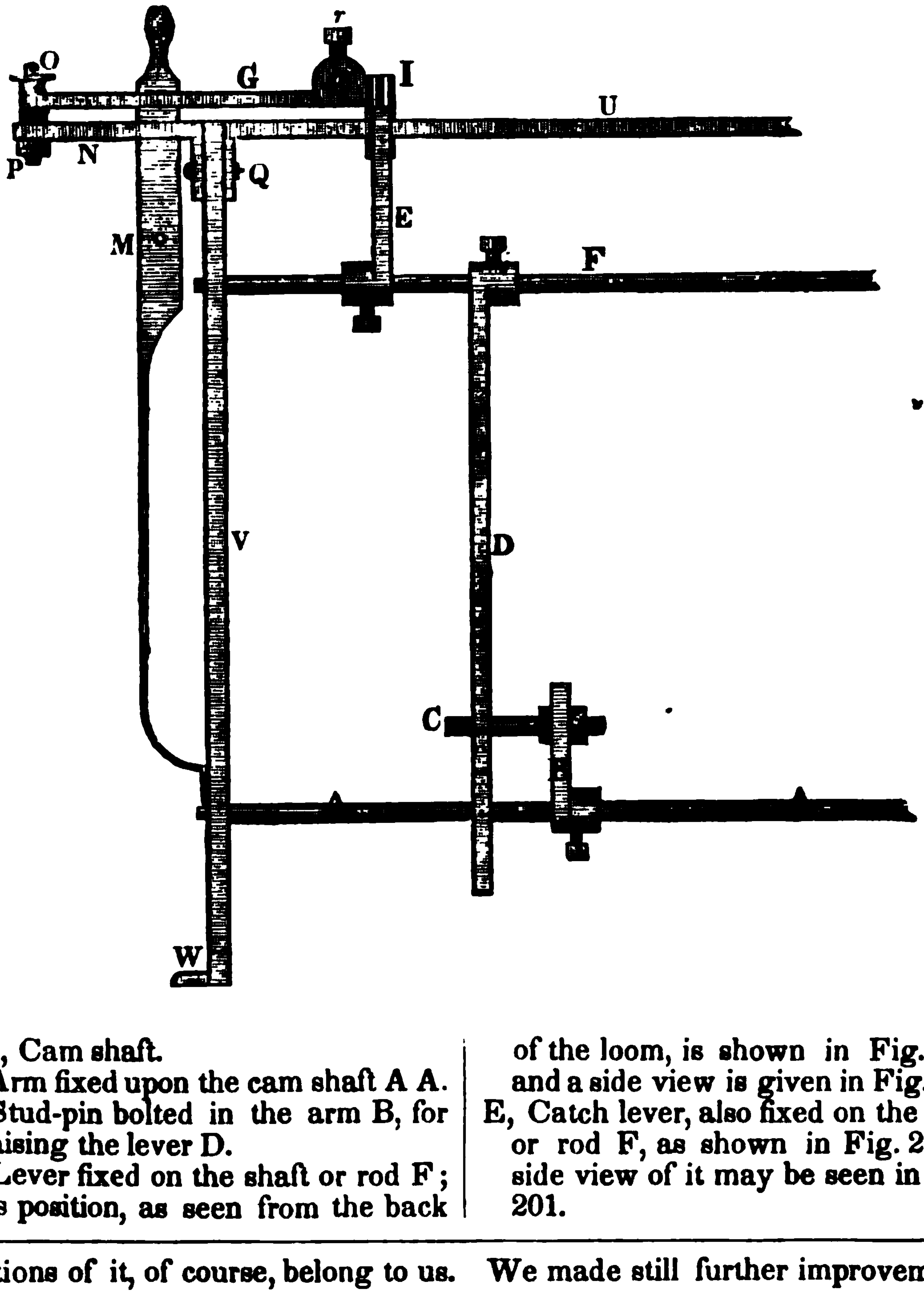
This is a motion for throwing the loom out of gear when the weft thread breaks or becomes exhausted in the shuttle. No less than 43 patents have been obtained, up to the year 1844, by different individuals in Europe and America, who thought they had succeeded in hitting upon something which would effect this object about as perfectly as the nature of the case would allow: but, with only two exceptions, all these schemes, however ingenious, have proved unsuccessful, and, in most instances, have brought poverty and ruin upon their unfortunate authors; a circumstance, alas! of every day occurrence with inventors.

The contrivance which we shall at present consider has been found to answer well, on looms for weaving heavy goods; and from the annexed index of its various parts, aided by the description, we think the reader will be able to understand the nature of its operation.*

* This motion originated with us, in the beginning of the year 1831, at which period we applied it to a power-loom for weaving *Marseilles quilts*; and the patents obtained in England by Mr. Bullough and Mr. Ramsbottom, for modi-

Fig. 200, represents a back elevation of a common power loom, having the fork and grid mechanism attached thereto; Fig. 201, a side elevation, in section, of so much of the loom as will enable us to show the application of the motion; and Fig. 202, a plan view of part of the apparatus detached from the loom.

Fig. 200.



A A, Cam shaft.
B, Arm fixed upon the cam shaft A A.
C, Stud-pin bolted in the arm B, for raising the lever D.
D, Lever fixed on the shaft or rod F; its position, as seen from the back of the loom, is shown in Fig. 200, and a side view is given in Fig. 201.
E, Catch lever, also fixed on the shaft or rod F, as shown in Fig. 200, a side view of it may be seen in Fig. 201.

fications of it, of course, belong to us. We made still further improvements on the motion in the years 1836 and 1838, for which we obtained patents in November, 1839, in the name of Moses Poole, of the Patent Office, 4 Old Square, Lincoln's Inn London. We also secured patents for the same invention, in France and Belgium, through Henry Truffaut, Esq., patent agent. As we shall have occasion to enter more fully into the investigation of the respective merits of different motions for stopping the loom when the weft thread breaks or becomes exhausted in the shuttle, in the next section, we will therefore, offer no further remarks upon the subject here.

F, Shaft or rod fixed underneath the breast beam, or rather a little inside of it, (towards the lay;) it reaches from side to side of the loom, and rests on the frame in suitable bearings.

G, Lever working on the stud-pin O. (See Fig. 200.) This stud-pin is secured by a screw nut P, in the outer part of the slotted piece N.

h, Round pin made to fit in the socket of the lever G, as shown in Fig. 202, and forms the fulcrum of the fork, the fork working freely upon it: this pin *h*, may be secured at any required distance to suit the proper working position of the fork I, by means of the set screw *r*.

I, The fork which plays against the weft thread every time the lay approaches the breast beam: this fork, when it meets with the weft thread, presses it against a few coarse dents in the outer edge of the reed, near the selvage of the cloth, the under extremities of the prongs of the fork entering the dents below; but the resistance of the weft thread will prevent the fork passing through to its full distance, and consequently the other end of the fork, with the hook or catch upon it, will be elevated, allowing the arm B, with its stud-pin C, to give free motion to the lever E, on the rod F, in case the weft thread is not broken or has become expended on the bobbin.

J, (Fig. 201,) Lay sword, showing the lay and upper rail L, to receive the reed.

K, The race board.

L, Upper rail to receive the reed, in the usual way.

M, The belt-shipper or spring-rod, for throwing the loom in or out of gear; it is precisely the same as those used in common power looms.

N, (Fig. 202,) Stand, bolted at one side of the loom, outside the end of the breast beam, as shown in Fig. 200; in this stand there is a slot made like that marked N, in Fig. 202, into which the shipper M, is inserted in the usual way.

O, Stud-pin forming the axis of the lever G, which lever should vibrate freely thereon: the stud-pin O, is bolted firmly in the slotted piece N, by means of the screw nut P, (see Fig. 200;) the place where it is to be inserted is indicated by a small round hole in Fig. 202.

P, Screw-nut to secure the stud-pin O, firmly in the extreme end of the slotted stand N, as shown in Fig. 200.

Q, (Fig. 200,) Bolt which secures the slotted piece N, to the frame of the loom.

r, Set-screw for securing the round pin which carries the grid I, and by which set-screw its distance from the reed is regulated.

S, (Fig. 201,) Prongs of the fork I.

T, Fulcrum of the fork I, which fulcrum is made upon the bent end of the round pin *h*, as shown in Fig. 202; a portion of this pin *h*, is left out in Fig. 201, in order to show the form of the upper end of the lever E, (which may be called the *hammer*,) and also the shape of the hook or catch end of the fork; the position, however, of the fulcrum of the fork I, (shown in Fig. 202,) is correctly represented at T, Fig. 201; from which explanation, no difficulty can possibly arise to those loom-makers and manufacturers who may wish to construct the motion.

U, Breast beam, which may be made of either wood or cast-iron.

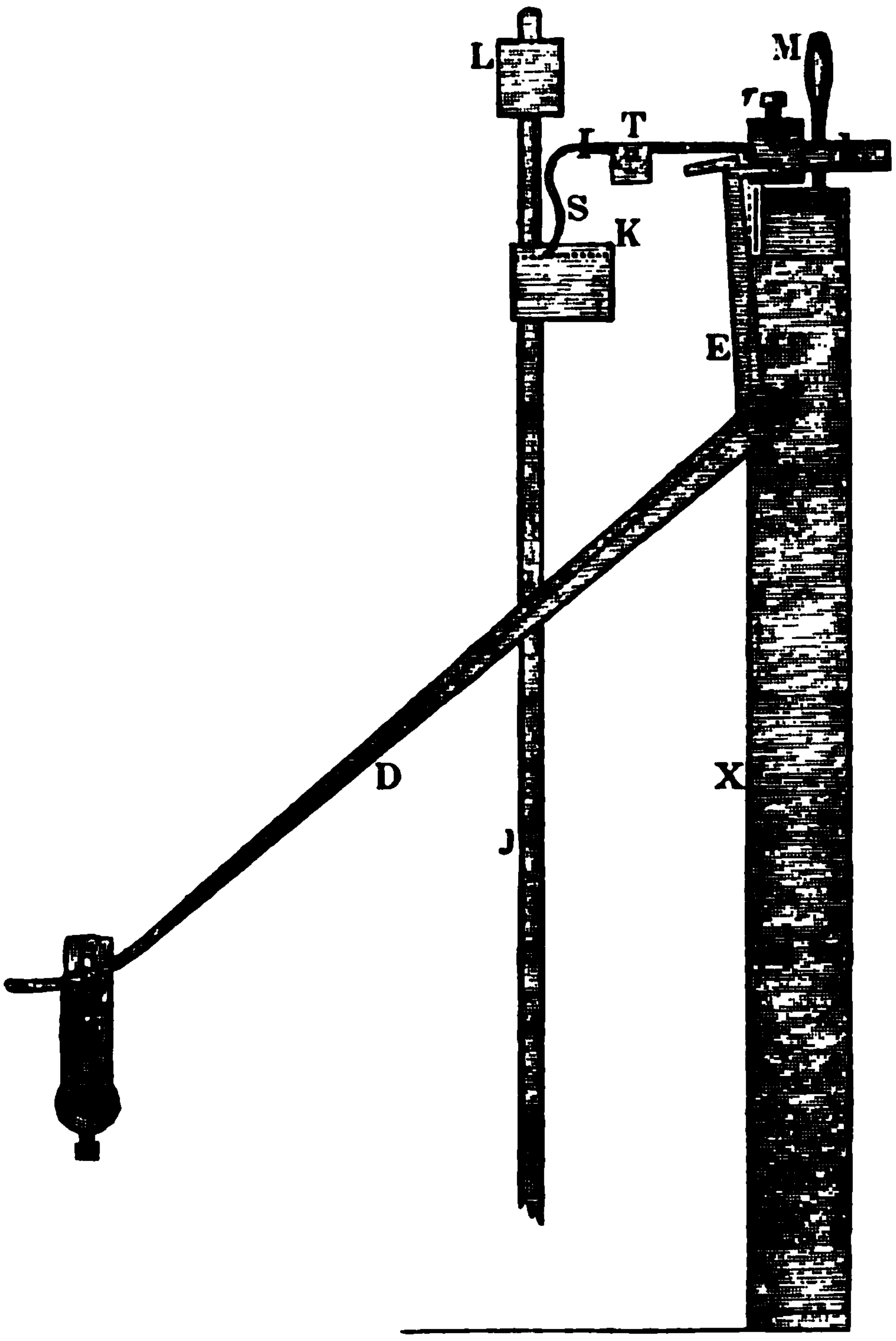
V, (Fig. 200,) Framing of one side of the loom, which is secured to the floor by means of a suitable bolt passed into the flange or projection W.

W, Flange or projection by which the loom is screwed to the floor; there are four such flanges to a common loom, one to each post.

X, (Fig. 201,) Post of the loom in section: the other parts in this Fig., being also in section, the ordinary side-framing is not shown in connexion with the post X; and, besides, we wish to avoid every thing which approximates in the least towards *mystification*.

The fork I, is made of wrought iron; it resembles a common eating fork at one end, and is bent as shown at S, Fig. 201; the other end, or that nearest the breast beam, is made flat and formed into

Fig. 201.



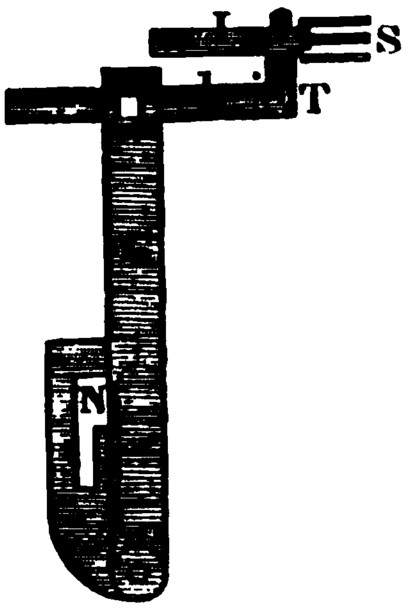
a hook, as represented in the Fig., for the purpose of catching the hook or shoulder of the lever E. The flat end is made a little heavier than the fork end which plays into the reed, so that it may always fall on the hammer of the lever E, unless raised by the action of the weft thread, or rather the action of the fork coming in contact with the weft thread and carrying it against the reed, thus causing the hook end of the fork I, during the forward motion of the lay, to be raised out of the jog in the upper end of the lever E, so that this lever will always miss the hook or catch and pass on without interruption, until the weft thread is broken or becomes exhausted in the shuttle.

The levers E, and D, are fixed firmly, by set screws, on the shaft or rod F; and motion is communicated to them from the cam shaft A A, (see Figs. 200 and 201,) by means of the slotted arm B, and stud-pin C, which pin may be regulated (up or down) in the slot of the arm B, (see Fig. 201,) according to the distance that is necessary to move the hammer on the upper end of the lever E, forward,

for the purpose of unshipping the belt from the tight pulley on to the loose one.

Now, it will be evident, that so long as the weft thread continues unbroken, the loom will continue in operation; but should it break, or cease to be delivered, the fork will meet with no resistance, and will consequently pass through the reed to the full distance to which it is regulated, thus allowing the bent nib or hook at its other end, near the breast beam, to fall on the hammer at the upper end of the lever E, first dropping on the inclined back projection of the hammer, but during the forward motion of the lay, the nib or hook will slip into the jog or notch, as represented in Fig. 201. The stud C, will now act on the lever D, and, consequently the lever E, by means of the jogged hammer at its upper end, will carry the fork I, with the lever G, and the round pin *h*, which forms the fulcrum of the fork, forward, until the side or edge of the lever G, comes in contact with the belt-shipper M, and drives it out of the jog or notch N, as represented in Fig. 202.

Fig. 202.



There is a small plate, with three or four wires fixed in it, in the form of a coarse reed, for the points of the grid (at K,) to work through, as the reed could not stand the wear and tear of continual use; besides, the prongs of the fork could not be made to work with precision through the reed, unless it were very coarse.

For coarse cotton goods, the fork need only have three prongs; but for fine goods, such as muslin, four prongs will enable it to act with greater certainty. The reed of the loom in which this motion is to be applied, should be made to extend beyond the selvage of the cloth on that side of the loom where the fork is to be placed, so that the reed-maker may have room to insert five or six strong dents in it, sufficiently far from the selvage that the *fork may not come in contact with the teeth or outer edge of the temple.* The distance

between these dents should be nearly $\frac{3}{16}$ths of an inch, for coarse fabrics, but for fine goods $\frac{1}{8}$th of an inch would, perhaps, be better; or, in the latter case, the fork might be made with an additional prong and the distance between the dents remain as in the former instance. In applying this motion to a loom where the reed is not made for the purpose, if it be of sufficient length, a few of the dents may be drawn out, and five or six coarse ones inserted; but should the reed not be long enough to admit of this, a small additional piece may be made with coarse dents, and placed at the end of the large reed; it should be well secured, or the prongs of the fork would be liable to strike against the dents, instead of entering between them, and thus cause much damage.

There is a small piece of brass, of the form of a grid, with flanges at each side, let into the shuttle-race or race-board, and on a level with it; this piece is fastened down by four small wood screws, two at each side; the slots of this piece are well smoothed out, and its upper surface is polished: it has one slot for each prong of the fork I; and into these slots the prongs work at each vibration of the lay: the slots are of sufficient depth to prevent the weft thread from getting under the points of the prongs, for if this took place, the loom would be directly thrown out of gear, although the weft thread remained unbroken. The depth of the slots in the grid piece, and the position of the prongs of the fork I, are shown in Fig. 201; the dotted line below the letter K, points out the depth of the slot.

Should the weft thread break or become expended, however, on the side of the loom opposite to that on which the motion is fixed, while the shuttle is passing towards the motion, the loom will instantly be thrown out of gear; but, on the contrary, should the weft break or become expended during the passage of the shuttle from the motion, the loom will not be thrown out of gear; because the arm B, with its stud C, will not then be in a position to act on the lever D.

If it be desired to stop the loom without losing one pick, a suitable connexion must be formed with the belt-shipper from the other side of the loom for that purpose; which any practical weaver may effect without difficulty. For the generality of goods, however, the motion at one side of the loom, as represented in Figs. 200, 201 and 202, will answer the purpose well enough without any addition thereto.

Packing Machinery.—A correspondent in the *Mechanics' Magazine* suggests, that the grease used for machinery about to be

packed, should be subjected for about an hour, to a heat of 230° Fahr. in order to evaporate its watery particles; and that with it be mixed a good portion of fresh-burned charcoal, reduced to an impalpable powder.

Preservation of Iron from Rust.—A mastic or covering for this purpose, proposed by M. Zeni, and sanctioned by the Societé d' Encouragement, is as follows:—Eighty parts of pounded brick, passed through a silk sieve, are mixed with 20 parts of litharge: the whole is then rubbed up by the muller with linseed oil, so as to form a thick paint, which may be diluted with spirits of turpentine. Before it is applied the iron should be well cleaned.

From an experience of two years, upon locks exposed to the air, and watered daily with salt water, after being covered with two coats of this mastic, the good effects of it have been thoroughly proved.—*Bull. d' Encour.*

Method of giving a black and glossy coating to cast iron trinkets, and other articles of the same material.—This composition is simple, and offers the invaluable advantage of efficaciously resisting the action of the atmosphere, and even of weak acids, so that the process may be employed for coating a great variety of cast utensils commonly used in our families. The coating easily fixes itself on cast iron, and may also be used on hammered iron, but with less certainty of success in the latter case than in the former.

Attach each of the articles to be coated to an iron wire bent above into a hook, and apply a thin coat of linseed oil; the coat must be thin, to prevent the oil from running, forming asperities or knots where it collects. Hang them eight or ten inches above a wood fire, so that they may be completely enveloped in the smoke. When they have been thus exposed to a brisk fire for about an hour, lower them so that they shall be near the burning coals, without touching them; at the expiration of about fifteen minutes remove the articles, and immediately immerse them in cold spirits of turpentine.

Any articles which, after this last operation, may be found deficient in brilliancy, or not sufficiently black, are to be re-exposed to the burning coals for a few minutes, and again dipped in the spirits of turpentine.

This process, which may be variously modified to suit different articles, may, from its simplicity, be extensively applied, and will prove useful in all cases in which cast utensils are subject to rapid oxydation.

SECTION TWELFTH.

FIGURED WEAVING.

Weave, brothers, weave!—Swiftly throw
  The shuttle athwart the loom,
And show us how brightly your flowers grow,
  That have beauty but no perfume!
Come, show us the rose, with a hundred dyes,
  The lily, that hath no spot,
The violet, deep as your true love's eyes,
  And the little forget-me-not!

Sing,—sing, brothers! weave and sing!
  'Tis good both to sing and to weave;
'Tis better to work than live idle,
  'Tis better to sing than grieve.

Weave, brothers, weave!—Weave, and bid
  The colours of sunset glow!
Let grace in each gliding thread be hid!
  Let beauty about ye blow!
Let your skein be long, and your silk be fine,
  And your hands both firm and sure,
And time nor chance shall your work untwine,
  But all,—like a truth,—endure!

So,—sing, brothers, &c.

Weave, brothers, weave!—Toil is ours;
  But toil is the lot of men;
One gathers the fruit, one gathers the flowers,
  One soweth the seed again!
There is not a creature from England's King,
  To the peasant that delves the soil,
That knows half the pleasures the seasons bring,
  If he have not his share of toil!

So,—sing, brothers, &c.

BARRY CORNWALL.

The first loom for weaving figured fabrics, by power, which we shall notice, is a damask loom; but before beginning to describe it we shall offer a few observations regarding damask textures generally.

Damask is a variegated textile fabric richly ornamented with figures of flowers, fruits, landscapes, animals, &c., and is a rich, elegant and expensive species of ornamental weaving. The name is said to be derived from Damascus, where it was anciently made, with engines invented by that celebrated individual, E. K. Arphaxad.

The tweel of damask is usually half that of full satin (a full satin is woven with 16 leaves of headles, as represented at page 109,) and, consequently, consists of eight leaves, moved either in regular succession, or at regular intervals.

The chief seat of the damask table-cloth manufacture is at Lisburn, Lurgan, and Ardoyne, (near Belfast,) Ireland, where it is considered as the staple, having proved a very profitable branch of traffic, and given employment to many thousands of industrious people.

Damask table-cloths, &c. are manufactured extensively in the town and neighbourhood of Dumfermline, in Fifeshire, Scotland; but, in point of texture, those made in Ireland greatly excel them, and particularly so the goods produced by Michael Andrews, Esq., of Ardoyne, and John Coulson, Esq., of Lisburn; which gentlemen are, *without exception*, the *best* manufacturers of this species of fabric in Europe. Damask table-cloths are also manufactured extensively in Belgium, at Silesia (Austria,) and in different parts of Russia. In the last of these countries the texture is coarse, and is commonly known by the name of ***Russian diaper***; the patterns, however, often display great taste; the cloth has but few picks of weft to the inch, but it is passed between two powerful iron cylinders, which flatten out the threads, and give the texture a finer appearance than it would otherwise have; the goods nevertheless wear well, and are much used in the houses of the middle classes.

The Emperor Nicholas holds out every encouragement, through his agents in different parts of Europe, to all workmen of talent in the department of figured weaving. Sixty or seventy of the best weavers in Great Britain, France, and Belgium, have already emigrated to Russia, for the express purpose of establishing manufactures of every description of figured goods in that country.

The table-cloth manufacture in Belgium, is mostly confined to Courtray; the principal manufacturer there is M. Alexandre, a very intelligent and worthy individual. In France the most extensive manufacturer of this kind of goods, is M. E. Feray, of Essonne, Seine et Oise: this gentleman employs about 100 damask looms, and as many for weaving other stuffs; he has two large mills, be-

sides his damask factory, and an extensive machine shop; the table-cloths produced by him are of a very superior quality. Mr. F. obtained his knowledge of this business in Ireland, where he seems to have been a pretty frequent visiter, both before and after commencing it on his own account. We would state, however, that for various reasons which we could name, neither his establishment, nor any other in France, can compete successfully with those of Ireland in the production of linen damasks. Table and piano-forte covers are manufactured pretty extensively in the north of England: but in regard to the finer kinds of linen damask, there is no great prospect of their ever driving the *Irish* manufacture out of the market.

This branch of industry might be established with success in the United States of America. The raw material could be grown in many parts of the country, as the climate seems to be well adapted to it; and until such time as sufficient quantities of flax could be raised to supply the home consumption, a profitable business might be carried on in the production of table and *piano-forte* covers, in all their varieties. We are convinced that 5,500 power looms, at least, could find employment provided that the *influx* of the foreign article was impeded, by suitable import duties: but until this is done, it will be impossible (even for the best power loom machinery in the world) to contend against the manufactures of foreign countries, in a branch of industry, where the most skillful manual labour goes for comparatively nothing; the compensation received by those workmen who are there employed in the manufacture being merely sufficient to keep soul and body together. Even steam power, in such a case, would soon not have a leg to stand upon, in contending against such famished loons; for coals, and the wear and tear of machinery cannot be kept up without some expense. If we were permitted to suggest *locations*, in the United States, where power looms might be erected, we would say, that 500 might be established at Saco, Maine; 500 at Lowell, Mass.; 500 at, or near Providence, R. I.; 500 at Paterson, N. J.; 500 at Troy, N. Y.; 500 at Mannayunk, 500 at Pittsburg, Pa.; 500 at Columbus, Ohio; 500 at Richmond, Va.; 500 in Georgia; and 500 more might find profitable employment in *Iowa* and *Michigan*. These numbers, however, could easily be augmented from time to time, so as to keep pace with the increase of population, as well as to meet the *foreign demand*.

Damasks are woven in the Jacquard and draw looms, and also in the cylinder or barrel loom. Mr. Coulson uses the draw loom en-

tirely, because he *imagines* it to be more *applicable* to his very complicated and extensive patterns; whereas, Mr. Andrews, employs the Jacquard principally, (as do nearly all the other enterprising Irish manufacturers of the present time,) and produces equally perfect work, and as extensive patterns, if not superior to those of Mr. ——— : but, Mr. C., being a gentleman of the old school, has long since *determined in himself*, to discountenance every valuable improvement which is introduced into the trade, and consequently, his once celebrated establishment is now fading into the "sear and yellow leaf," while those manufacturers of less contracted views are adopting extensively the new improvements as they rise.

In table cloth weaving the ground leaves of headles are generally placed seven or eight inches, in front of the mounting which produces the figure; for, if they were too near the mails of this mounting, they would in working strain and break the warp threads, producing in the face of the cloth little loops, or something not unlike the *ears of birds* (house sparrows.)

Silk damasks are manufactured in great quantities in Lyons, Paris, and several other parts of France, for ladies' shawls, &c.; they are also made pretty extensively in Spitalfields, and Manchester, (England,) and at Paisley, (Scotland.) Damasks have of late years been introduced wholly composed of cotton, in the form of shawls, and other kinds of ornamental dresses; and are mostly exported for the use of the *negro* population, both in *Africa* and *America.**

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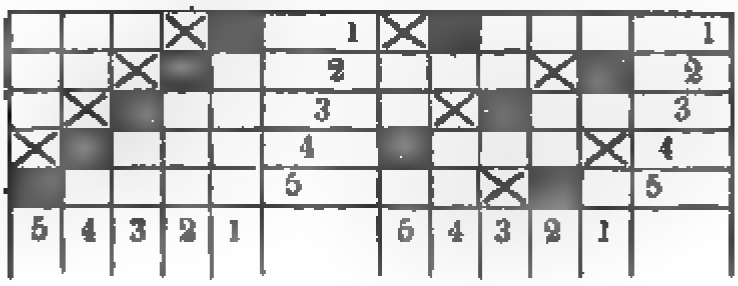
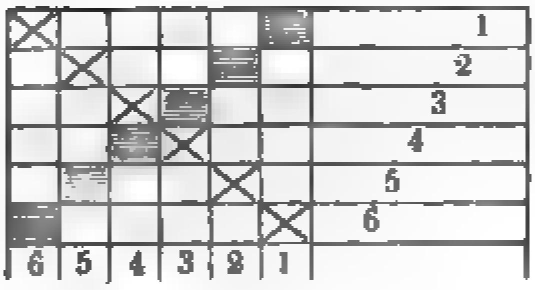
* Messrs. James and Lawrence Holmes, manufacturers (late of Paisley, Scotland) have recently erected 30 or 40 hand-looms at Harsimus, N. J., for weaving imitation and damask shawls. The introduction of this kind of manufacture into America, will, no doubt, be the means of starving thousands of ingenious Paisley weavers; or at least, of compelling them to seek their bread on the American shores. We understand (from report) that an *enlightened* Scotch capitalist has offered the sum of 80,000*l.* for some *new* improvements, lately discovered by an Eastern *antiquarian*, by means of which these shawls may be produced with as much facility as the common brown sheeting which costs nine cents a yard. The price of the fabric, therefore, can only exceed that of common brown sheeting by the cost of material, in as much as the labour in producing it is no greater. It is reported, by the antiquarian *himself*, that a little girl of from nine to ten years of age can tend four or five of his improved weaving engines, which are driven by a powerful *wind-mill!*

Some of the most useful plans of tweeling are as follow:

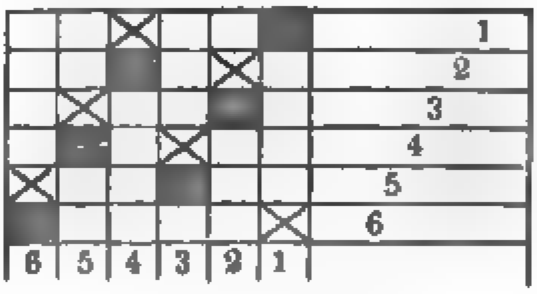
A Regular. B Broken.



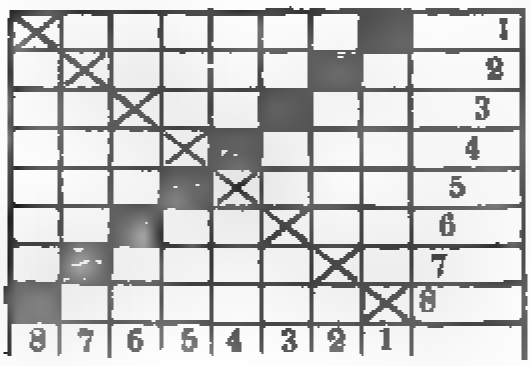
C Regular.



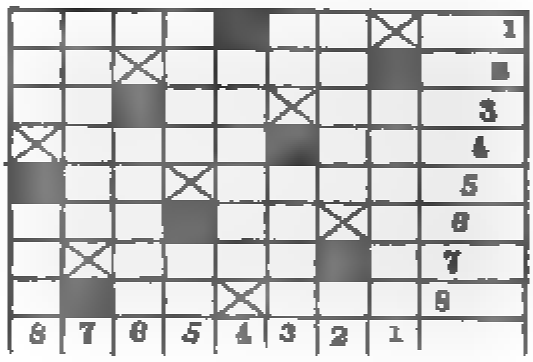
D Broken.



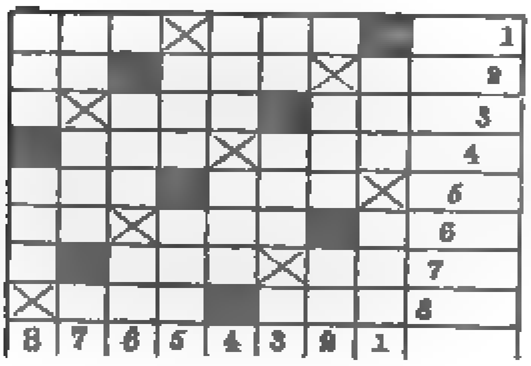
E Regular.



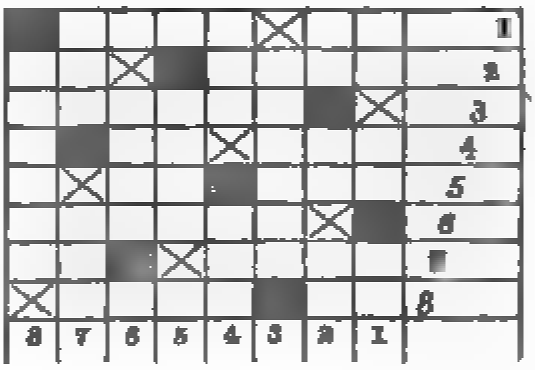
F Broken.



G Broken.



H Broken.



These plans represent the different tweels in use at the present day among manufacturers of damask table-cloths. The tweel marked A, is a regular tweel, and that marked B, a broken tweel; they are both on five leaves of headles, numbered from 1 to 5: table cloths woven with this tweel for the ground are called *bastard damask*. The tweel shown at C, is a six leaf regular tweel, and

that at D, a six leaf broken tweel; they are both woven with six treadles: these tweels are not much used in linen or cotton, being mostly confined to silk damask weaving. E, is an eight leaf regular tweel, and F, an eight leaf broken tweel; they are both woven with eight treadles. G, and H, are two other kinds of eight leaf broken tweels, also woven with eight treadles; that marked H, is most commonly used by table-cloth manufacturers. The cross marks in these plans denote raising cords, and the black squares sinking cords. The methods of arranging the leaves of headles, treadles, &c. (which work the ground,) will be hereafter more fully explained.

Damasks, for table-covers, are sometimes woven with a five leaf tweel, and often with one of eight or even more leaves. When woven with a *five leaf tweel* they are usually denominated *bastard damasks*, and when more than eight leaves are employed for the ground they are called *superfine damasks.* The eight leaf tweel, as before observed, is that which is usually termed the damask tweel.

The number of threads in each mail of these fabrics is likewise variable, being three, four, or more, according to the intended fineness of the web. Taking advantage of this circumstance, the damask weaver has seldom occasion to change his harness, though he may require to change the set of his reed; which is easily done by varying the number of threads in each interval in the same manner. This plan, for the sake of economy, is often carried still farther, particularly where great accuracy is not required, by drawing an extra thread in a mail occasionally at regular intervals, in the same way that weavers miss their overplus headles when the headles are finer than the reed. Damask, however, *when wanted very fine, and when much accuracy and delicacy are required in the design and colouring of the pattern, may be woven in a full harness;* but, as these require a great quantity of cordage, and consequently are very expensive in mounting, *especially when the pattern is large*, the full damask harness is not common.

The Irish damask table cloth manufacturers put 4 threads in the mail generally, and give 4 threads of weft to the change of pattern, changing the pattern twice for once over the ground treadles. By this means a finer point is obtained, and, of course, a nearer approach is made to the full harness principle; for, it is evident, that if there were eight threads of weft instead of four threads given to the change of pattern, the point would be coarser in the same proportion.

In looms mounted for weaving extensive patterns, considerable

economy is also obtained by introducing what is termed single and double mounting. In the single mounting, every mail, in each part, has a cord and needle to itself, and therefore, can be raised independent of any other; the double mounting is merely certain portions of the border or body gathered. By using these a vast deal of expense is saved in drawing and designing, particularly in extensive patterns.

For example, suppose a damask table-cloth were to be woven, containing 63 porters of warp and 5 threads in each mail, then we have

126 porters of warp;
40 threads in one porter;

5)5040 threads;

1008 mails in the whole web.

Now, these may be divided into parts thus:—

For one side border,	18	designs,	single;
For the body of the web,	26	do.	double;
do. do.	12	do.	single;
do. do.	26	do.	double;
For the other side border,	18	do.	single;

100 designs;
10 mails in a design;

1000 mails;

which deducted from the above given quantity of warp, leaves 8 mails, or 20 dents of the reed for selvages. Here the designer may draw any pattern he pleases for the borders to the extent of 18 designs, or 180 cords of the figuring machine; in the body of the table cover, he may also draw any pattern he pleases on the 12 designs in the centre, as that part is single mounting but it must be such as will join with the 26 designs of double mounting on each side, so as to form all the patterns into one complete group. In this example the tie of the harness will be 180 cords single, of the figuring machine, of the borders; 260 cords double, and 120 single, for the body; making in the whole 560 needles for the Jacquard.

Patterns for damask table-cloths are designed on 10 by 10 paper, and may be woven square, by adapting the number of picks on each change of pattern to the intended thickness of the cloth. Table-

cloth patterns are generally composed of coats of arms, groups of flowers, landscapes, birds, trees, &c.

Damask harnesses are sometimes mounted for the draw loom; sometimes on the Jacquard plan; and sometimes the principles of both these are combined, as, for example, when a coat of arms is to be woven in the centre of a table-cloth. In the last case, the borders and part of the body are commonly mounted for the Jacquard machine, while the part for working the armorial bearings is adapted to the draw-boy (see draw-loom.) In large mountings, however, there are frequently four or more simples, and sometimes four or more pulley-boxes, these boxes being placed in the most convenient position for the weaver; and when any of the simples are not employed, they are tied up and laid aside until wanted in their turn.

It may be further remarked, that, in weaving damasks, in general, when any portion of the harness cords are raised by the Jacquard, to form a flowering shed, these cords must be kept raised by the machine until the proper number of picks to the card is given.

The common damask shawl has uniformly four threads in the mail; it is woven with an eight leaf satin tweel, like either of those marked F, G, or H, in the preceding examples; and it may be woven with four or eight picks of weft to the change of pattern. The warp and weft of this class of goods are, for the most part, of different colours.

The loom which now claims our attention, is for weaving tablecloths, bed-covers, window-curtains, &c., and was made the subject of a patent, in the United States, by Messrs. Tompkins and Gilroy, of North Providence, R. I., May 9th, 1835; and is the *first power loom with Jacquard machinery*, for weaving these kinds of textures, ever erected in America.*

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* Mr. John Haight, of Harsimus, N. J., obtained a patent, May 17th, 1834, for a power loom, with Jacquard machinery, for weaving ingrain carpets; and we believe he had some 20 or 30 machines constructed on this principle, in the year 1835, at Messrs. Godwin, Clarke & Co's. establishment, Paterson, N. J., which were put in operation at Little Falls. After persevering, however, for some time, *with a zeal worthy of a better cause*, and expending the round sum of $30,000, in the undertaking, the whole concern was abandoned, owing to imperfections in the machinery, which it would appear Mr. H. was unable to remedy. We understand Mr. Haight has lately sold this patent for $60, to a carpet manufacturing company in Massachusetts; which company also paid him other $60 for one of his machines. Some alterations have been made upon this loom, by an individual in the employ

Patents were granted to us by the English, French, and Belgian governments for this loom in an improved condition, rendering it available in the manufacture of many kinds of coarse goods; and we believe there are at present in these countries about 340 machines of the improved construction in operation. The British patents are in the name of Moses Poole, Esq., of the Patent Office, London, the French, in the name of P. Aug. Pihet (of the firm of

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of the company, which appear, from report, to be turning out very advantageous to them. We have been told that as much as $400,000 has been lately offered, (see New York Evening Post, March 19th, 1844,) by an English firm, of high standing, for the patent-right of the loom in its present improved state; but the offer was peremptorily refused as being *far too trifling a compensation for so valuable a concern.* We regret that we neither can give the name nor address of this firm; but our present belief is, that it must be either the Rothschilds or Baring, Brothers and Co. Few carpet manufacturing companies in Europe could raise such a sum, however willing they might be to purchase the machine; but we do not think they would make much exertion upon the subject, when there are already no less than *seven different* kinds of power looms in Great Britain, weaving Coach lace, Ingrain, three ply, and Brussels carpeting, averaging 20 yards per loom daily, sometimes with as many as 10 or 15 shades of colour, and producing goods of excellent quality. Four of these inventions have been in operation in England since the year 1831; there are we believe three carpet power looms in France, and for which patents have been secured, besides one in Belgium and two in Russia; most of these looms work exceedingly well, and besides possess the merit of being simple in construction.

The statement published in the Evening Post, in regard to the sum of £80,000 being offered by a British capitalist for the carpet power loom therein alluded to, has turned out, as we were sure it would, to be a *falsehood*, see N. Y. Journal of Commerce of June 20.

We have examined models, drawings, and description, lodged in the Patent Office, at Washington, of a loom for weaving carpets by power; which loom was made the subject of a patent in the United States, granted to Erastus B. Bigelow, Esq., Lowell, Mass. May 26th, 1842. The specification and drawings of this patent carpet loom will be given in a work we are preparing which will treat entirely of the manufacture of Carpets and Coach lace, &c. &c. &c., by power; when the various motions claimed by Mr. B. will be compared with those of other parties; manufacturers and others interested, in Europe and America, will thus be enabled to see what truly belongs to each claimant.

"When people treat you ill, and show their spite, and slander you, enter into their little souls, go to the bottom of them, search their understandings; and you will soon see that nothing they may think or say of you need give you one troublesome thought."

P[illegible] Aug. [illegible] Paris, and the Belgian, in the name of Henry Truffaut, patent-agent, [illegible] Rue [illegible], Paris. A description of this improved loom, accompanied with suitable engravings, is given in the London Repertory of Patent Inventions, vol. 10 (1838), page 123, where it is stated by the editor, that it is the first power loom in Great Britain to which Jacquard machinery has been applied; this, however, is a mistake, as we applied Jacquard machinery to power looms for weaving Marseilles quilts and various kinds of carpeting, so far back as the commencement of the year 1831.

Fig. 203.

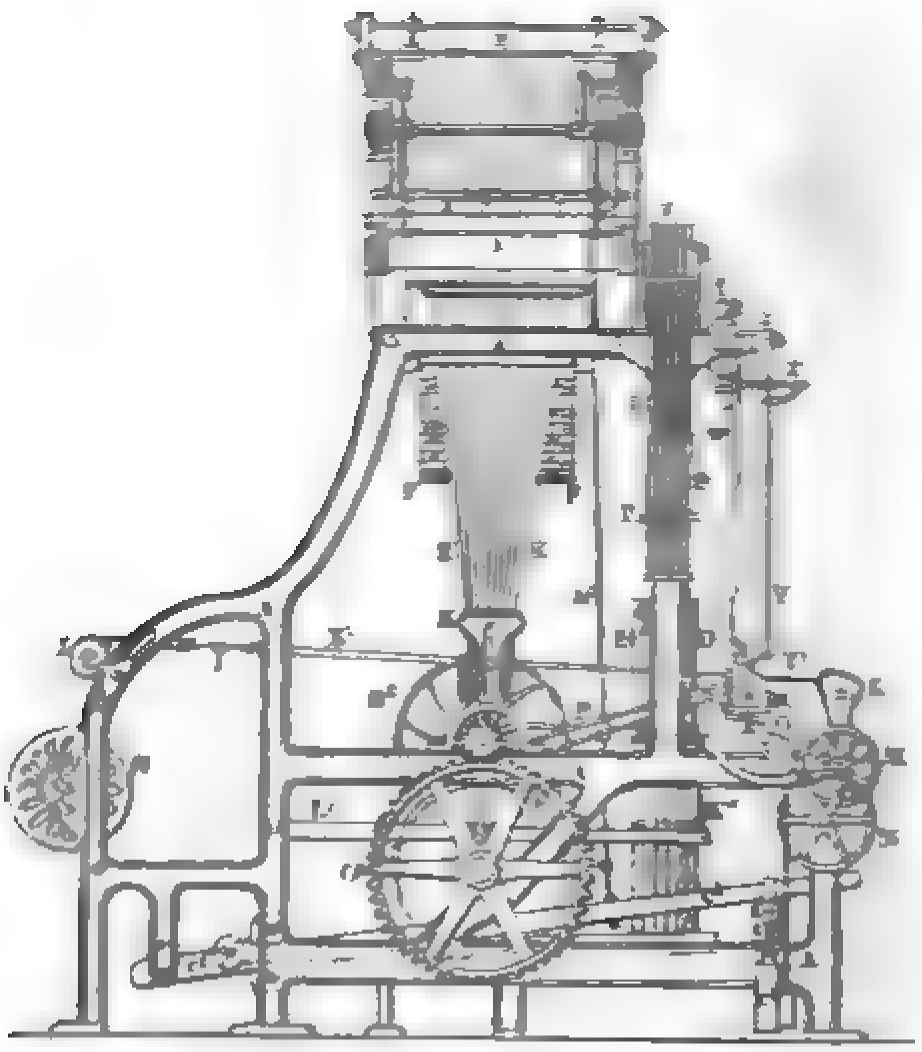
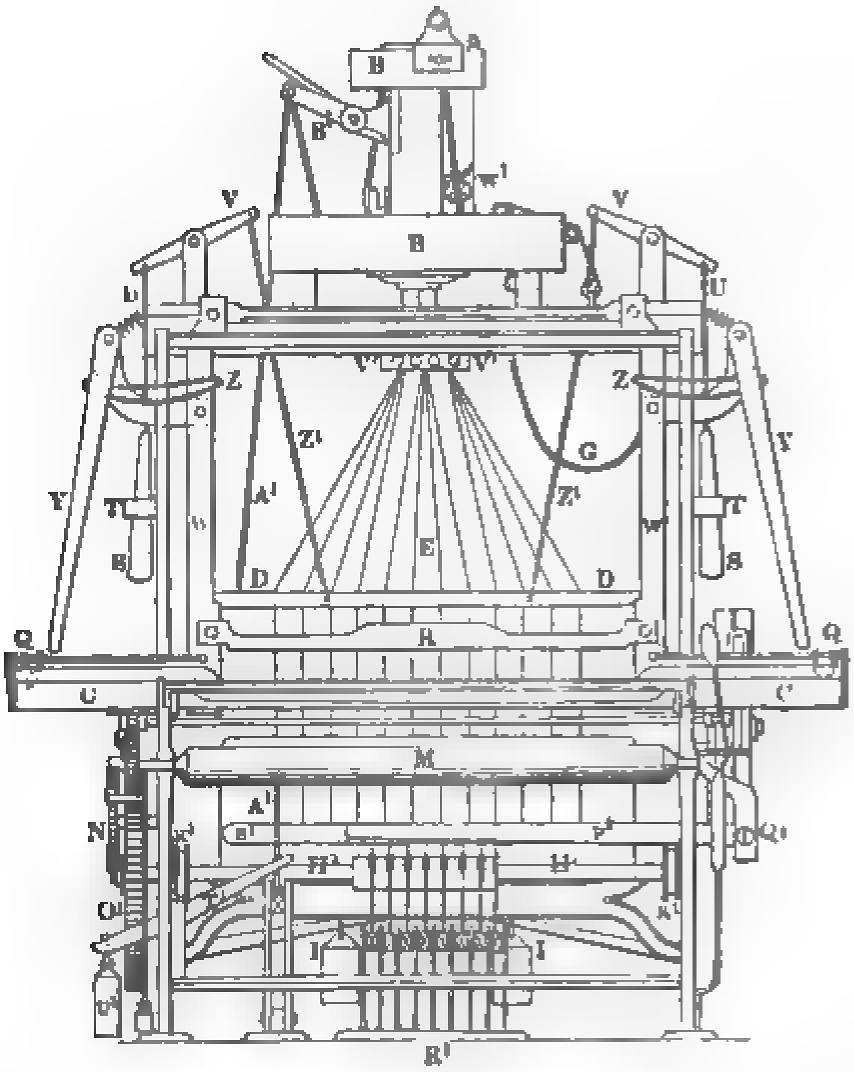


Fig. 203, represents a longitudinal or side elevation of the loom as constructed in Great Britain, France, and Belgium; Fig. 204, a front view, in elevation; Fig. 205, a cam wheel for working the cylinder treadle, Fig. 206, a plan of that part of the cylinder treadle into which the cam wheel is inserted, for the purpose of working the Jacquard machinery; Fig. 207, a side view of the notched cam or wheel which governs the shuttle motion; Fig. 208, the apparatus for throwing the shuttle; Fig. 209, a modification of the cam wheel shown at Fig. 205; Fig. 210, the apparatus for throwing the loom in and out of gear; and Fig. 211, the cam shaft, carrying eight cams.

Fig. 204



A A A A A, Fig. 203, Frame of the loom.

B B, Jacquard machine, as constructed by Mr. Thomas Morton, of Kilmarnock, Scotland.

C C, The lay.

D D, Leaves of headles for working the ground.

E E, Jacquard harness, or back mounting, for producing the figure.

F F, Pattern-cards.

G, Fig. 204, wires to hold the pattern-cards, at each side, and about four inches from their ends. Into these wires the cards drop as they are delivered from the cylinder.

H, Fig. 203, The yarn beam.

I, Fig. 203, Lease rods.

J, Whip roller over which the yarn passes in its progress to the harness E E.

K, Stand to support harness board having a governing slot and bolt to raise or depress it, to suit any position required.

L, The breast beam over which the cloth passes in its progress to the roller M.

M, The cloth roller.

N, Ratchet wheel which communicates motion to the cloth roller M.

O, Protector, by means of which the loom is thrown out of gear in case the shuttle, from any cause, fails to enter the shuttle-box.

P, Fig. 203, Arm which connects the lay to the crank shaft.

Q, Q, Fig. 204, Pickers for driving the shuttle.

R, Fig. 204, Top rail to steady the reed, in the usual way.

S S, Weights to counterbalance the front mounting.

T T, Guides to keep the weights S S, in their proper positions.

U, Wires, or cords, which connect the weights S S, to the top jacks V V.

V V, Top jacks.

W W, Swords of the lay, which are suspended above at X, (see Fig. 203.)

X, Stand to support the lay, one at each side of the loom.

Y Y, Picker sticks.

Z Z, Triangles for giving the picker

sticks motion; a view of this apparatus will be had at Fig. 208.

A′, Wire or cord, which connects the Jacquard arm B′, to the cylinder treadle C′.

B′, Jacquard lifting arm.

C′, Cylinder treadle to which the lifting arm B′, is connected, by means of the wire or cord A′ (see Fig. 203.)

D′ D′, (Fig. 205,) Cam wheel to work the treadle C′, by means of which the flowering shed is opened: this cam wheel is keyed on the cam shaft inside the framing of the loom; its position is indicated at the left, in Fig. 204, by the slotted guide, in which the end of the cylinder treadle is perceptible.

E′ E′, (Fig. 209,) A modification of the cam-wheel D′ D′.

F′, (Fig. 208,) Dog to throw the shuttle, by knocking against the short end of the triangle Z, in the backward motion of the lay.

G′, Adjustable face of the dog F′, by the bringing of which nearer to, or farther from the fulcrum of the triangle Z, a greater or less degree of force, or rapidity of motion may be given to the shuttle.

H′, (Fig. 211,) Cam shaft carrying eight cams I′, the form of which is shown more clearly at J′.

I′ (Fig. 211,) Cams to work the ground headles; these cams may have small rollers at their ends if preferable instead of being plain, as shown in the Fig.

J′ (Fig. 211,) One of the cams I′.

K′, (Fig. 207,) Shuttle wheel, divided into 9 equal parts, 5 parts being left solid and 4 parts cut out, as shown in the Fig.; the part marked N′, is double. One of these shuttle wheels K′, is keyed on the cam shaft H′, inside the framing of the loom, at each side, as shown in Fig. 204.

L′, (Figs. 203 and 207,) Shuttle lever having a projection M′, made upon it, which works in the shuttle wheel K′: this lever L′, works on a fulcrum fixed to the framing of the loom, as shown in Fig. 203.

M′, (Fig. 207,) Projection of the lever L′, working in the shuttle wheel K′.

N′, Double space on the shuttle wheel K′, for the purpose of causing the shuttle to miss every ninth pick of weft, or every ninth revolution of the crank shaft, although the other parts of the machinery continue in operation; the object of this is, to give the Jacquard machinery sufficient time to operate. In setting the shuttle wheels K′, on the cam shaft, care must be taken that they be so adjusted in relation to each other as to permit the double spaces N′, to hold up the projection M′, of the lever L′, every ninth revolution of the crank shaft.

O′, (Figs. 203 and 204,) Cam-shaft wheel, which has nine times the number of teeth of the pinion that works into it, as shown in Fig. 203.

P′, (Fig. 204,) Counter marches to which the headles D D, are connected by cording, in the usual way, underneath.

Q′, (Fig. 204,) Fulcrum of the countermarches P′.

R′, (Fig. 204,) Rack to guide the ground treadles and keep them steady in their respective places: the ends of the treadles are shown in the rack.

S′, Long march of the cylinder treadle C′, for the purpose of carrying the wire or cord A′, which works the Jacquard lifting arm B′, outside the selvage or warp yarn.

T′, (Fig. 204,) Small lever, having a weight U′, at its left end, for counterbalancing the cylinder treadle C′, to which it is connected.

U′, Counter balance of the cylinder treadle C′.

V′ V′, (Fig. 204,) Small rollers for guiding the neck of the harness E E.

W′, (Fig. 204,) Cylinder with the hooks which turn it, in the usual way, as at Figs. 93 and 94.

X′, (Fig. 203,) The warp yarn.

Y′, The cloth.

Z′, (Fig. 204,) Wires or cords, which connect the headles to the jacks V V.

The apparatus shown at Fig. 210, is for the purpose of throwing the loom in and out of gear; and to prevent confusion it is not represented in Figs. 203 and 204.

A″ (Fig. 210,) Crank shaft, with the apparatus for throwing the loom in and out of gear fixed on its end.

B″ B″, Belt pulley on the end of the Crank shaft A″, having two holes C″ C″, made in two of its arms, as shown in Fig. 210.

C″ C″, Holes made in the arms of the

pulley D'', to receive two stud-pins, which revolve with the pulley: these stud-pins are fixed into the slide piece L'', and are shipped in and out of the latch wheel D'', by means of a lever with a fork working into the hollowed-out place shown between the letters L'' L'', Fig. 210, as is well understood by all practical machinists.

D'', Wheel with latches E'' E'', inserted into its outer edges, in opposite directions, as shown in Fig. 210: these latches work on the fulcrum pins I'' I''; and the springs F'' F'', (which must be made of steel) keep the latches E'' E'', pressed down at their points (opposite to their fulcra,) against the cross-bar H'' H'', in opposite directions, as shown in Fig. 210.

E'' E'', Latches working into the outer edges of the wheel D''.

F'' F'', Springs to keep the latches E'' E'', constantly pressed against the cross-bar H'' H''.

G'' G'', Four small set-screws for holding the springs F'', F'', firmly, two set screws to each spring, as shown in Fig. 210.

H'' H'', Cross-piece of the latch-wheel D'', forming a part of the wheel D'', being cast with it.

I'' I'', Axis, or fulcrum of the latches E'' E''.

J'', (Figs. 205 and 206,) Small roller fixed in the cylinder treadle C', for the cam wheel D', (Fig. 205,) to roll on, by which means the Jacquard machinery is put into operation.

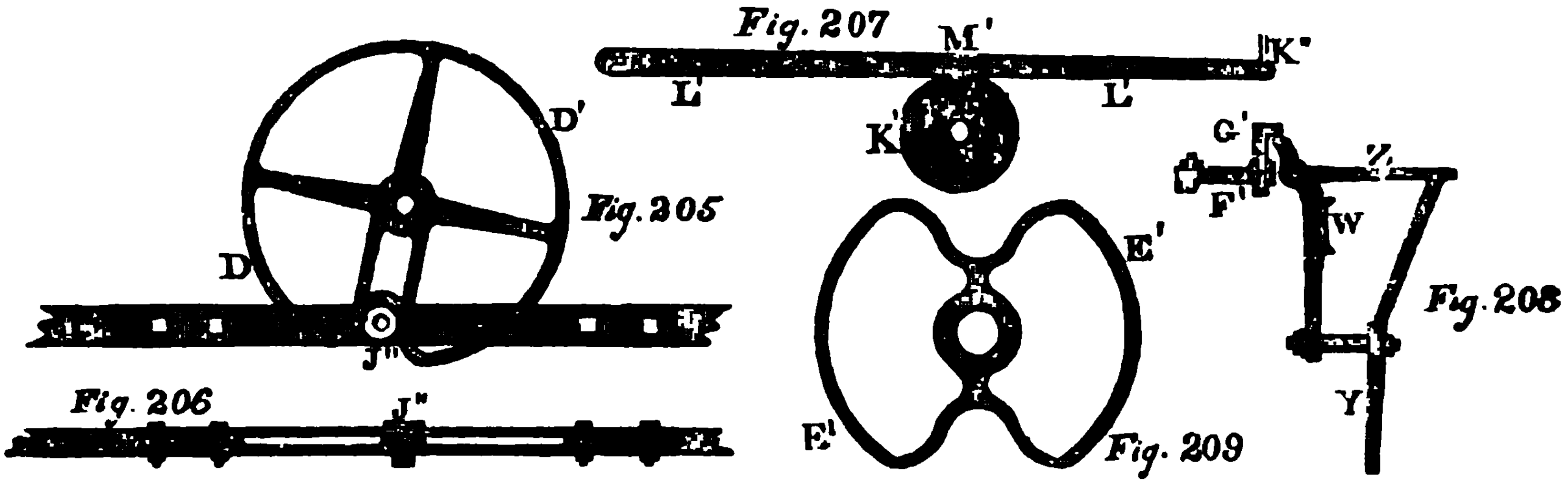
K'', (Figs. 203 and 207,) Lifting-rod connected to the lever L', for the purpose of lifting the dog F', and extends upward, as in Fig. 203, immediately behind the triangle Z.

L'' L'', (Fig. 210,) Slide-piece carrying stud-pins for the purpose of throwing the loom in and out of gear. The wheel D'' is keyed firmly on the extreme end of the crank shaft A'', as shown in Fig. 210, the stud-pins being slid in or out of it at pleasure, by the person who tends the machine: in Fig. 210, the apparatus is full geared, as when the loom is in operation. When the stud-pins, fixed in the plate L'' L'', are thrown into the wheel D'' D'', as shown in Fig. 210, the belt-pulley B'' B'', carries them round inside of the wheel D'', until they lock themselves in the ends of the latches E'' E'', which will be easily accomplished, because the latches E'' E'', being somewhat larger near their ends, at the cross-bar H'' H'', will be forced outward by the pins as the belt pulley B'' B'', revolves, until the stud-pins come up against the cross-bar H'' H'', whereupon the latches E'' E'', are instantly shut down upon the pins, holding them against the cross-bar H'' H'', when the loom continues its ordinary evolutions, until the stud-pins are slid out of the wheel D'' D''.

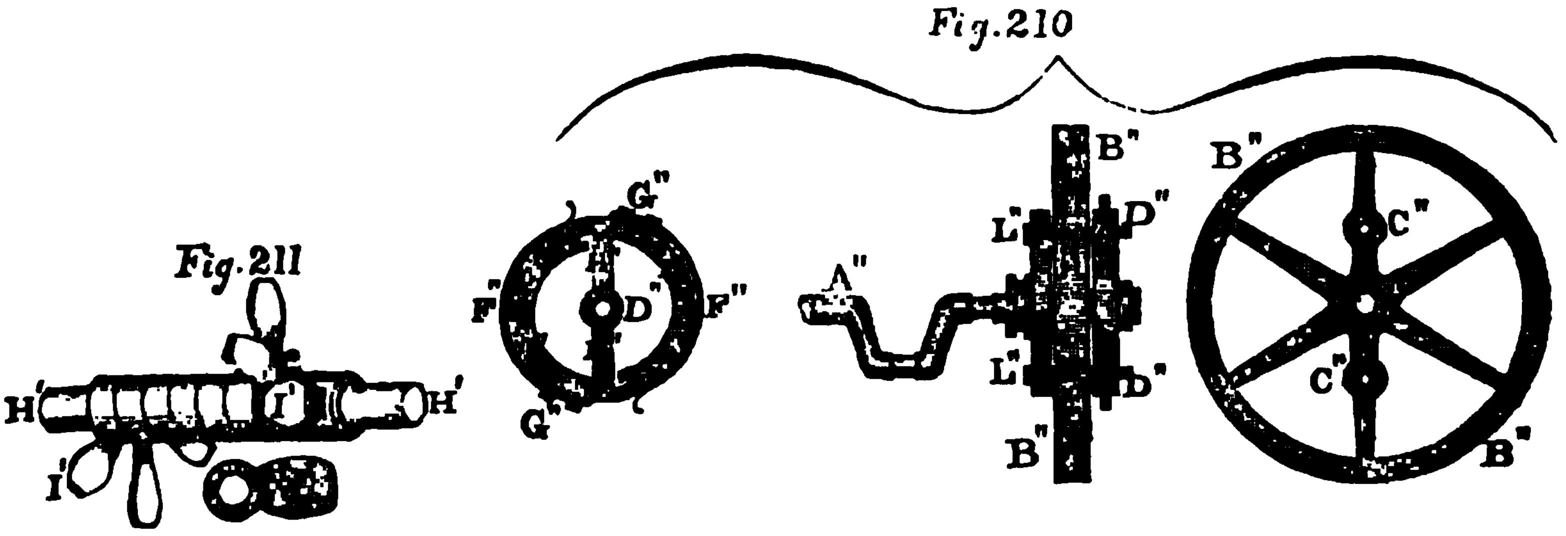
In this loom the ground-work of the cloth is considered as being made with eight leaves of headles. If the ground is required to be different, then, the arrangement will of course vary, according to the number of leaves of headles to be used; but to make the machine better understood, we have represented it with eight leaves of headles, and as many treadles to work them, movement to which is communicated in the following manner.

Upon the cam shaft H' H', (Figs. 204 and 211,) are fixed eight cams I' I', each being held firmly by three set screws, inserted at equal distances on the circumference of its hub. These cams I' I', work upon suitable iron shoes, bolted on the treadles (one shoe to each treadle) in regular succession from right to left, until they are all gone over and eight picks of weft given. It is with this design that they are placed spirally on the cam shaft H' H', as represented in Fig. 211. By this arrangement may be obtained all the positions required for

tweeling the ground. The cam wheel D′ D′, (Fig. 205,) is divided



into nine equal parts, eight of which are occupied by the cams I′ I′: the ninth part corresponds to the opening or jog of the cam wheel D′ D′. Motion is communicated to the cam shaft H′ H′, by the wheel O′, (Figs. 203 and 204,) shown on its axis; and the pinion which meshes into it (Fig. 203) is fixed on the end of the crank shaft, the whole receiving motion from the belt pulley B″ B″, placed on the opposite end of the crank shaft. The number of teeth in the pinion is nine times less than those of the wheel O′; that is to say for example, 162 teeth in the wheel O′, and 18 in the pinion; consequently, the pinion makes nine revolutions while the wheel O′, is making one; and the lay C, being connected at each side of the loom to the crank shaft, by suitable arms (one of which is shown in Fig. 203) will bring the reed into contact with the fell of the cloth nine times during one revolution of the cam wheel D′ D′.



But, it is necessary to remark, that for the satin or tweeled ground chosen (for example) eight picks of weft should be given to every change of the pattern produced by the Jacquard machinery; and while the change of pattern is being effected by the Jacquard, the shuttle should remain at rest, and consequently the ninth stroke of the lay C, would take place without giving motion to the shuttle. The lay C, is suspended from the top of the loom the same as in

common hand looms: the picker sticks Y Y, are connected to the swords of the lay (one at each side of the loom) by means of crutches (Fig. 204.) Suitable leather straps connect the picker sticks, one to each, to the extreme ends of the triangles Z Z, (Figs. 203, 204 and 208.) Motion for throwing the shuttle is communicated to the triangles Z Z, by the shuttle wheels K′ K′, working upon the cam shaft H′ H′, at each side of the loom (Fig. 204) inside the framing. One of these shuttle wheels is shown separate at Fig. 207; each is divided into nine equal parts, four of which are cut out and the other five project in the form of teeth; the fifth is joined to the fourth, as shown at N′, Fig. 207, and makes a double-sized tooth. A lever L′, at each side of the loom, as shown in Fig. 203, rests upon one of the shuttle wheels K′, and brings to the point of contact with it a projection M′, of lance-like form, which, when brought to a projection in the wheel K′, raises the lever, and when in the notch, lowers it; and thus the rotary motion of the wheels K′ K′, elevates and depresses alternately the lever L′, so that one of these levers is raised while the other is depressed, except when the two double projections N′ N′, (Fig. 207) of the wheels act together at the end of their revolution and hold up together. At the end of each of the levers L′ L′, is joined a rod K″ K″, (Figs. 203 and 207,) which is connected to a dog F′, (Fig. 208;) this dog F′, is attached to the frame-work of the loom above (one dog at each side) in such a way that it may easily move when the lever L′, is raised or lowered. In front of the dog F′, is adapted to the sword of the lay W, a mechanical arrangement (a side view of which is shown in Fig. 203, and a plan, as seen from above, in Fig. 208) of parts which we call a triangle; the triangle will make a circular and a horizontal movement alternately upon its axis. It will be evident, that when one of the levers L′ L′, is raised by one of the projections of the wheels K′, at one side of the loom, the corresponding dog F′, which is in connexion with it, through the medium of the lifting rod K″, will also be raised; and, on the contrary, it is lowered when the lever L′, falls into one of the notches in the shuttle wheel K′. When the lever L′, is lowered (as shown in Fig. 207) the rod K″, allows the dog F′, to be also lowered, just before the lay moves back far enough to impede it in its descent, the dog F′, dropping directly on a level with the short end of the triangle Z, and immediately behind it, will cause the triangle to turn quickly upon its axis, drawing, at the same instant, the picker-stick, with which it is connected by a leather strap, forward rapidly, which in its turn acts upon the shuttle. The rods K″ K″, (Figs. 203 and

207,) are a little flattened at their upper ends, forming shoulders, the flat parts take into the dogs F′ F′, (one at each side of the loom) and the shoulders serve to support the dogs F′ F′, and keep them from dropping down on the rods K″ K″. One of the slots made in the dog F′, is shown at Fig. 208, immediately above the letter F′. According to the arrangement of the shuttle wheels K′ K′, one of the picker-sticks Y Y, is left at rest, while the other is in motion, and they are both at rest when the large projections N′ N′, (Fig. 207,) on the shuttle wheels K′ K′, act simultaneously upon the levers L′ L′. At this moment the shuttle is not thrown, and it is then that the cylinder wheel D′ D′, produces a change of the pattern cards; that is to say, at every ninth revolution of the crank shaft, the lay at this time beating up against the fell of the cloth without adding any weft thread thereto.

From what has been said of this machine, we think no practical weaver or loom-builder will have any difficulty in comprehending the arrangement. In describing it we have not shown the mechanism for governing the giving out of the warp and taking up the cloth, because it is the same as that represented at Figs. 161, 162, 163, and 164; which see.

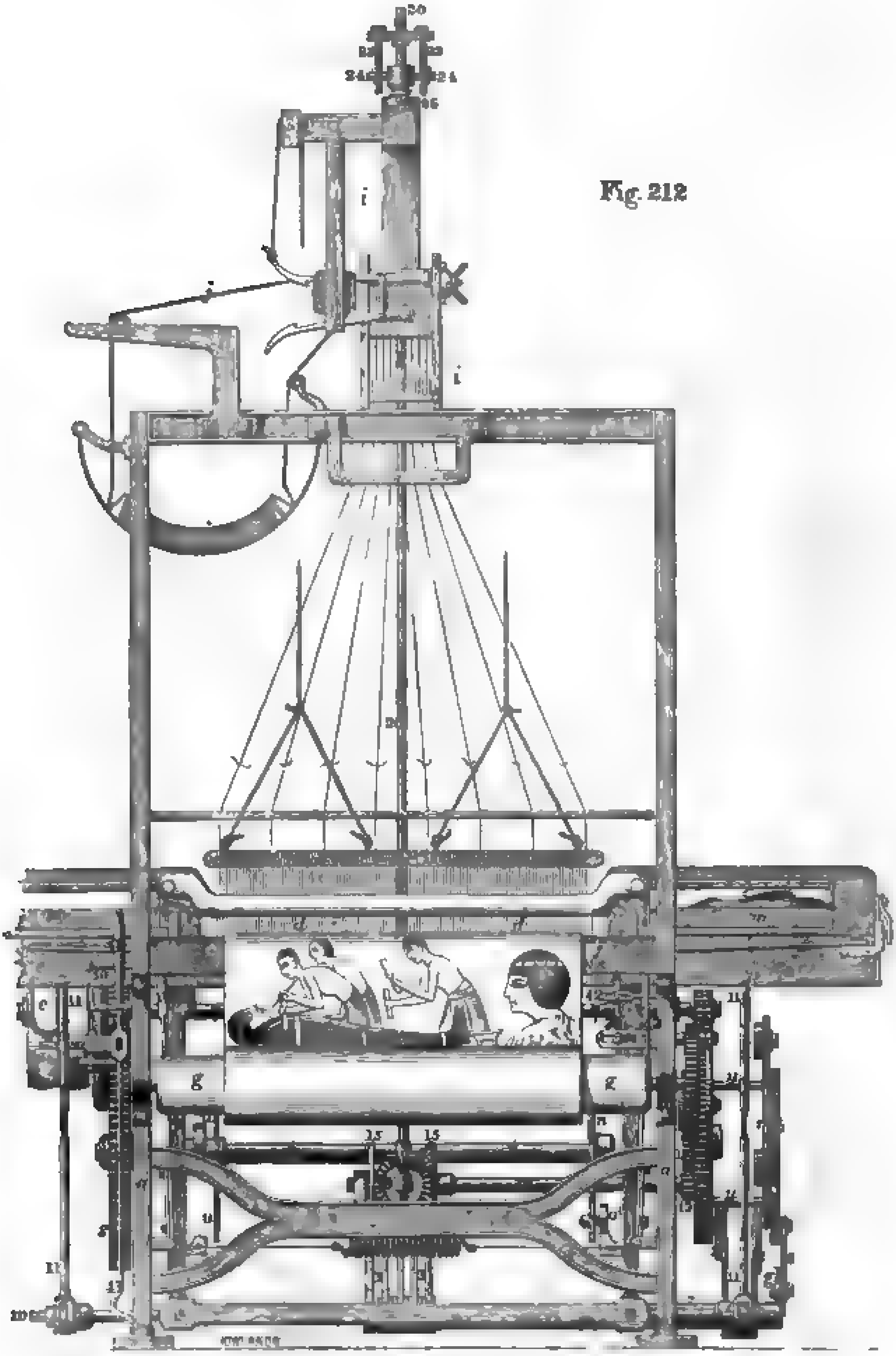
Figs. 212, 213, 214, 215, 216 and 217, represent a loom for weaving figured fabrics, such as are commonly known under the names of *imperial* or *French quilts*, *imperial petticoat robes*, and also *quilted vestings*; which loom was patented in England, Scotland and France in 1839; and the English patent, which is in the name of Thomas Yates, of Bolton-le-moor, county of Lancaster, was sealed 7th November, in the same year.

The apparatus for giving out the warp and taking up the cloth in this loom, being nearly the same as that now commonly used, we have thought it unnecessary to show it in the Figs.

The improvements consist, in a novel arrangement of mechanism in combination with the various essential parts of the ordinary power loom, for the purpose; firstly, of effecting with greater facility the shedding of the warps, in connexion with the headles, and working various descriptions of cloth, by means of revolving tappet plates, with bowls; and also a certain provision in such tappet plates, whereby the ground may be varied with readiness; secondly, in an arrangement of mechanism for the purpose of lifting and depressing the shuttle boxes, to or from the level of the shuttle-race in the lay, in those looms where two or more qualities, kinds or colours of weft, are to be employed; thirdly, in a certain and effective mode of raising the "griff" of the Jacquard machine in all such looms

where this apparatus is or may be employed; and, fourthly, in a contrivance or arrangement of mechanism, for the purpose of throwing the loom out of gear when the weft thread breaks or becomes

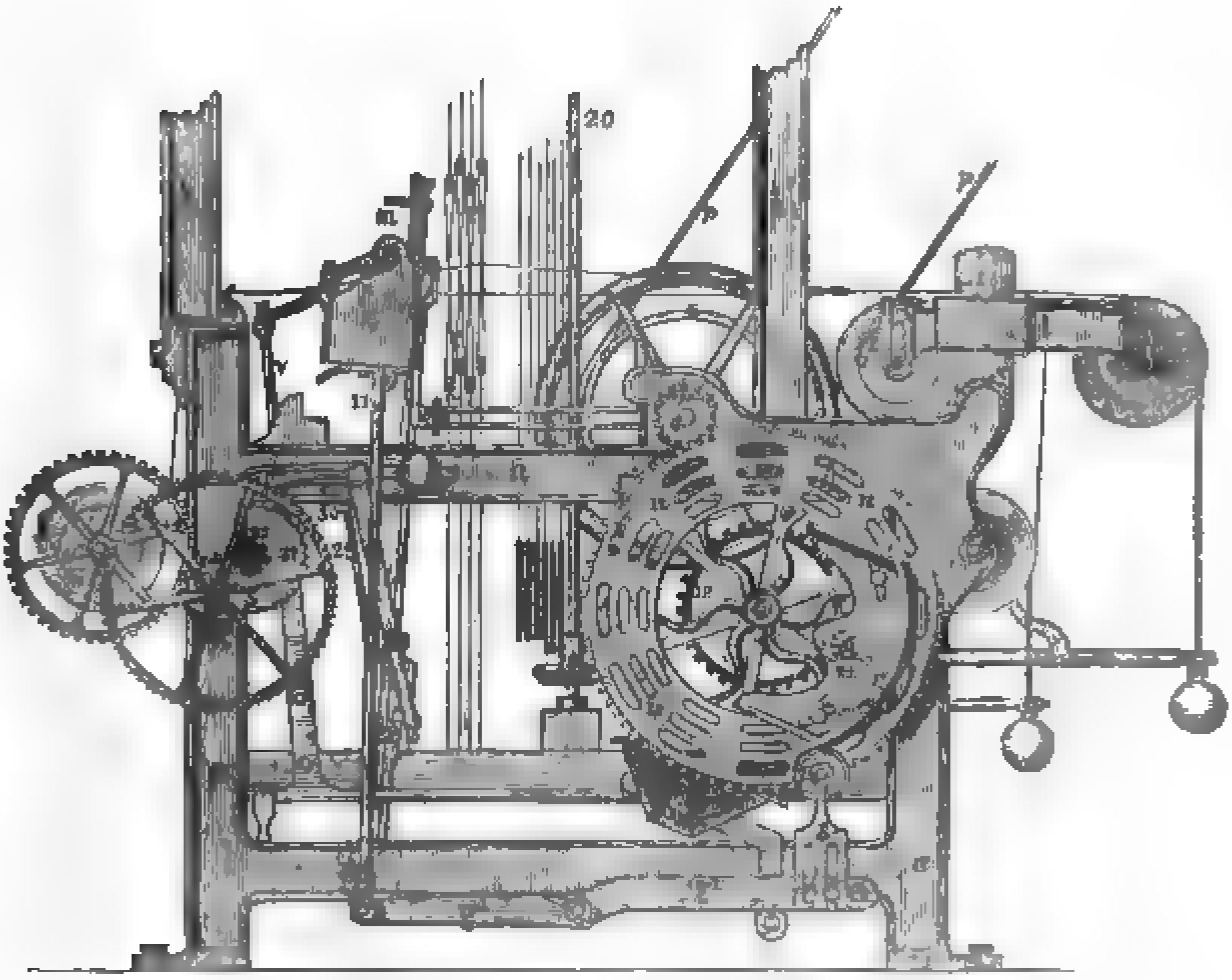
Fig. 212



exhausted in the shuttle, or when "the taking up" of the cloth upon the cloth roller is not equal to its production; such motion being governed by the ordinary beat or vibration of the lay.

Fig. 212, represents a front elevation of the improved power loom; Fig. 213, a side elevation, taken at the right hand side of Fig. 212; and Fig. 214, is a vertical section, taken through about the middle of the loom.

Fig. 213.



The framing of the loom is marked *a, a, a*, supporting the several warp rollers *b*, *b'*, *b*², from whence the warp threads proceed through the headles *c, c*, also through the reed *d, d*, of the lay *e*, over the breast beam *f*, to the cloth roller *g*, as usual. This loom is also provided with an additional framing *h, h*, for the purpose of supporting the Jacquard machine or apparatus *i, i*, with its pattern-cards *j, j*, hooked wires *k*, and lifting griff *l, l*. There are also two shuttle boxes *m*, which must be raised and lowered to the level of the shuttle-race, as occasion may require; and also peculiarly constructed tappet plates or wheels *n, n*, for the purpose of performing the requisite working of the ground.

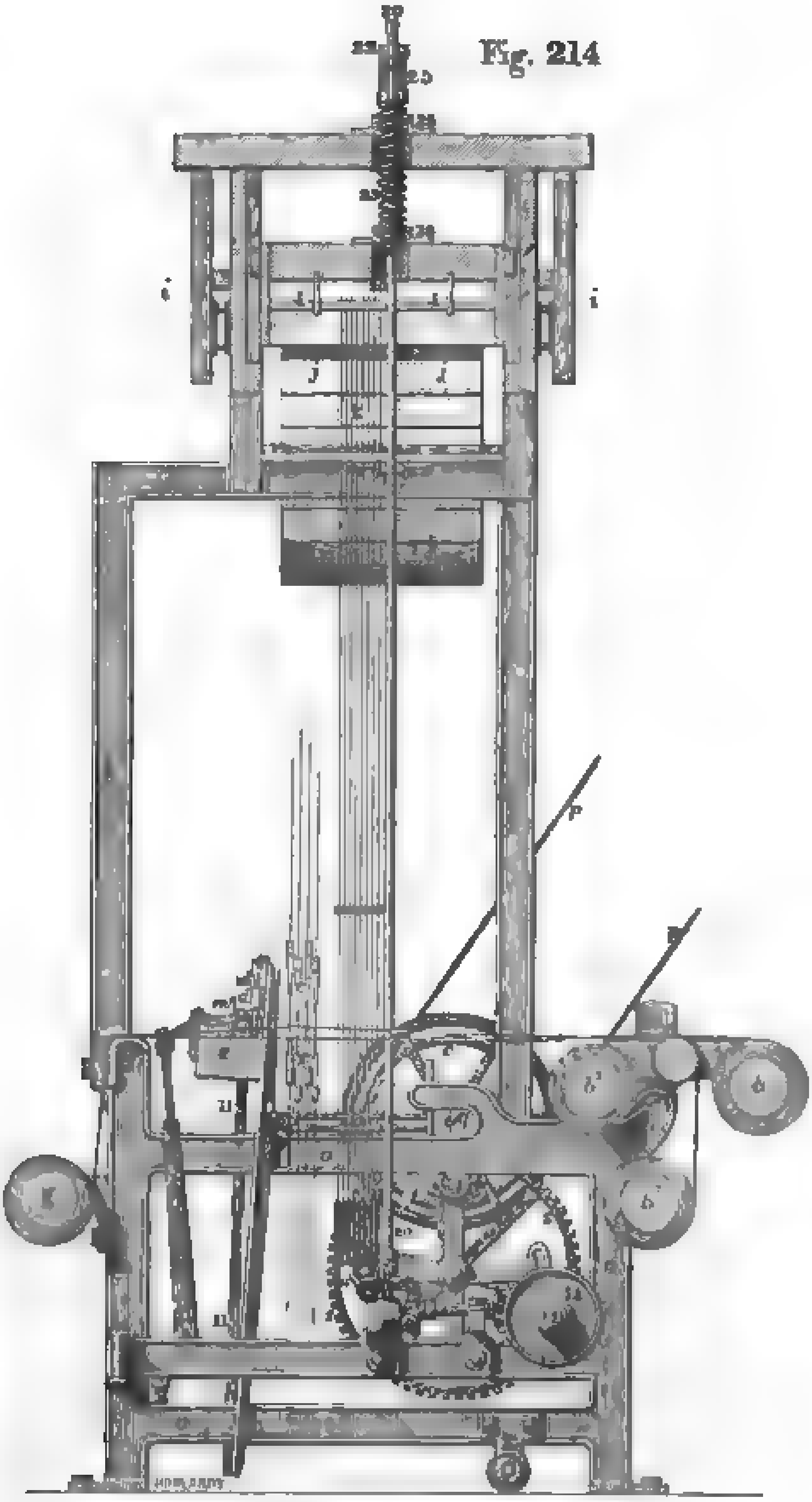
The power is to be applied to the driving pulley *c'*, by the strap *p, p*, and thus, by means of the crank shaft *q*, cause the lay *e*, to beat up the cloth; and also, by means of the pinion *r*, (Fig. 212) and

wheel *s*, upon the tappet shaft *t*, *t*, cause the tappets *n*, *n*, to revolve, and thus the alternate motion of the picker-sticks *v*, *v*, will be effected, as in ordinary power looms.

There is also upon the reverse end of the shaft *q*, a smaller pinion *w*, taking into the spur-wheel *x*, (Fig. 212) fastened by means of bolts *y*, *y*, to the tappet plates or wheels *n*, *n*, carrying their respective bowls 1, 1, 1, which act upon the inclined treadle-plates 2, 2, 2, (Fig. 213.) The treadle levers 3, 3, (an end view of which is shown in Fig. 212) are connected by the stringing to the headles *c*, *c*, and are all mounted side by side, each upon a separate axis, but formed as tubes, and placed one within another to save room; the fulcrum of these treadles is shown at *z*, Fig. 214. This arrangement of mechanism is peculiar to the first part of the improvements in the construction of looms. The tappet plates or wheels *n*, *n*, *n*, are provided with concentric slots or mortices 4, 4, Figs. 213 and 216, in which the studs of the bowls 1, 1, are fixed by suitable nuts; and it will be readily understood by any practical weaver, that by loosening the nut or nuts, and shifting these bowls in the concentric mortices 4, considerable variety of shifts, numbers, or changes "to the round" may be thus simply and readily accomplished. The description of cloth, by means of the tappet wheel may be easily varied in plain weaving, or in weaving *grounds or "quiltings" in combination with the figures produced by or with the Jacquard machinery, such as single or double cloth, satin, tweeled, plain, or stitched faces, called quiltings, &c.*

The second part of the improvements, namely, the arrangement of machinery for *lifting* and *depressing* the shuttle boxes to or from the level of the shuttle-race, will now be described:—Supposing the tappet bowls, just noticed, to be adjusted to weave a *plain double cloth, with the employment of two shuttle boxes*, or a figured cloth, woven in *different colours*, and having a *stitched* or *quilted surface*, the upper shuttle in the box *m*, containing the fine weft, is now just lifted up, as shown in Fig. 212, by means of a concentric tappet plate 6, 6, (Figs. 212, 213 and 217) fastened by bolts to the side of the outer tappet plate *n*, *n*, (see Fig. 212) as it revolves, acting upon the bowl or roller 7, in the carrier 8, (Figs. 212 and 213) attached to one end of the levers *g'*, *g'*, upon the cross shaft 10. To the other end of these levers *g'*, are attached vertical rods 11, 11, adjustable by a screw in the middle, which enter at the bottom of the shuttle-race in the lay, and thus project the shuttle-boxes, with the shuttles, upwards; the top shuttle is thus kept up out of the shuttle-race, as long as the concentric tappet plate 6, is acting

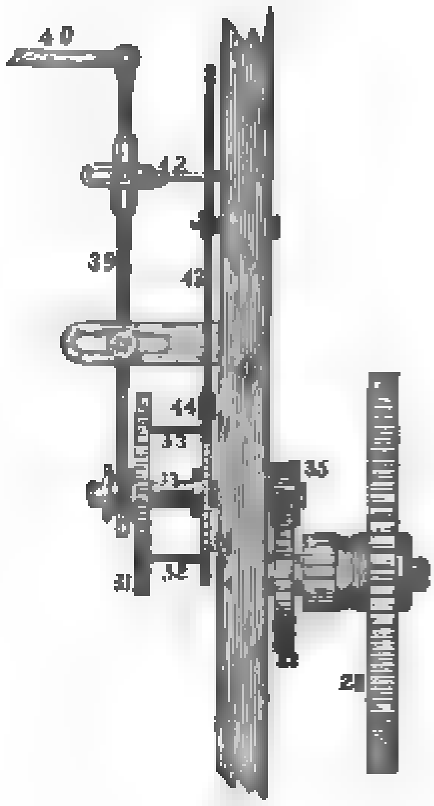
Fig. 214



upon the bowl 7;—that is long enough for the lower shuttle, containing *coarse weft, to put in one pick, prior to the Jacquard shedding, and one return pick of the same weft after the Jacquard shedding*, when the bowl 7, will immediately ascend, and allow the shuttle boxes *m*, *m*, to descend by their own gravity; and thus the *upper shuttle is enabled to put in two picks of fine, or coloured weft, before the Jacquard machine comes again into*

operation, and also two picks of fine, or coloured weft, prior to the next ascent of the shuttle boxes.

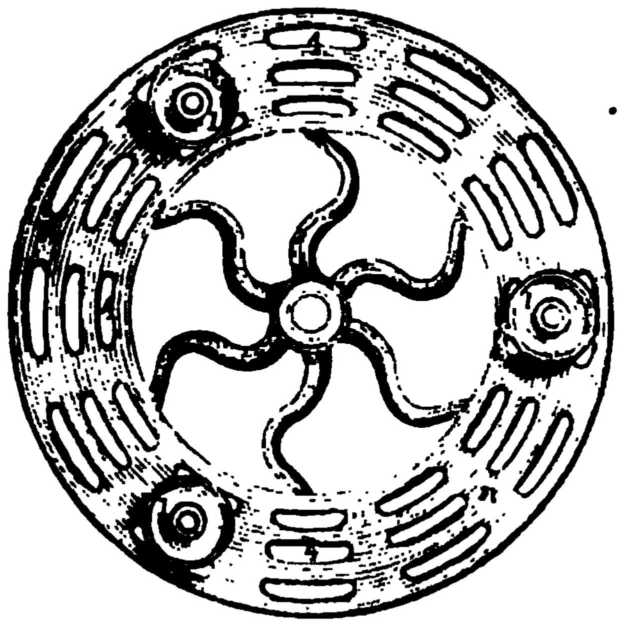
Fig. 215.



The third feature of the improvement comes into operation, in order to complete the weaving, or to put in the *quilting, or stitching threads, by shedding the coloured warps b', and b^2*;—this is accomplished by an improved method of lifting and lowering the griff of the Jacquard machine, in order to insure a perfect regularity and steadiness of action in moving either upwards or downwards. For this purpose a spur wheel 12, 12, is attached, to drive the small pinion 13, (Figs. 212 and 213) keyed upon the shaft 14; and upon the reverse end of this shaft 14, a pair of segments 15, 15, having beveled teeth formed, upon one sixth part of their circumference only, each driving successively, the pinion 16, upon the small cross shaft 17, (Fig. 214;) that is, these segments of teeth are so arranged, that as soon as the one segment of teeth 15, (Fig. 212) has turned the pinion 16, (Fig. 216) one half of a revolution in one direction, the other segment of teeth 15, instantly turns the pinion 16, one half of a revolution in the reverse direction. In order to transfer this reversing motion to the raising and lowering motion of the griff of the Jacquard machine, there is a bevel wheel 18, upon the other end of the small shaft 17, taking into a pinion 19, of half its diameter, at the lower end of the vertical shaft 20, 20, which has, at its upper end, a head-piece 22, 22, having side grooved pieces 23, 23, in which the pins 24, 24, fast upon the

head of the double screw 25, 25, (Fig. 214) work, and thus turn the double screw round. This double screw 25, 25, is cut half its length in reverse directions, and works in the guide 26, which will have the effect of lifting the griff through the required space, in half the time that the crank shaft makes one revolution.

Fig. 216.



The fourth part of these improvements in the construction of looms, consists, in an arrangement of mechanism, designed for the purpose of throwing the loom out of gear with the driving power, either when the weft breaks or becomes expended in the shuttle, or when the taking up of the cloth is not equal to the production. This is accomplished by the ordinary beat or vibration of the lay itself and *not at all dependent upon the coarseness or fineness of the weft thread.* A stud 27, in the sword of the lay, usually employed for working the taking up motion 28, operates upon a small lever 29, to which is attached the click 30, (Figs. 213 and 214) giving motion to the ratchet wheel 31, one tooth at every beat of the lay. Upon this ratchet wheel are four small pins 32, 32, (see detached Fig. 215, drawn to a larger scale;) this wheel runs loosely upon a small stud 33, which stud also carries a smaller ratchet wheel 34, keyed fast upon it, and having four small holes in its side, *corresponding with the pins in the ratchet* 31; this stud 33, also carries, at its outer extremity, a small pinion 35, which is driven by the spur-wheel 38, upon the shaft of the taking up wheel 28.

Thus it will be evident, to *persons conversant* with power loom weaving, that as the lay vibrates and beats up the cloth; and as long as the weft thread is put in, and the cloth sufficiently beaten up, the taking up motion 28, will cause the pinion 35, to drive the stud and ratchet round; but, in the event of the weft not entering the cloth, and the cloth has not been produced, the lay will not

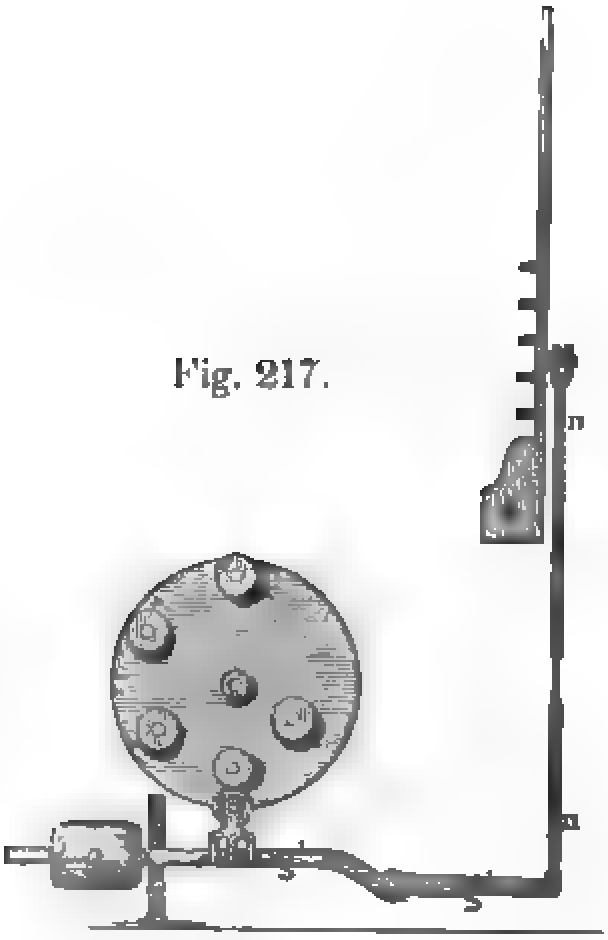


Fig. 217.

advance sufficiently to drive out the click 30, and ratchet 31, which wheel will now overtake the smaller ratchet, and as they are always held together by a spring behind the pins 32, will immediately enter the holes in the ratchet wheels 34, and thus vibrate the rod 39, which slides the horizontal bar 40, before the lever 41, (Fig. 212) and thus throw the strap from off the driving pulley. The horizontal sliding bar 40, now returns by means of the side motion of the setting off lever 41, and thus releases the pins from the holes. In the two small ratchet wheels there is a catch-piece 42, upon the rod 39; this catch-piece, as it returns, pushes the click lever 43, and click 44, onwards, and just advances the smaller ratchet wheel one tooth, in order to set the holes free of the pins, and thus be ready to start the loom again.

Fig. 216, represents a detatched and enlarged view of one of the tappet plates, with its tappets or bowls, moveable in the concentric mortices; and Fig. 217, represents a modification of the mode of lifting the shuttle boxes, and is here shown as capable of lifting and sustaining five boxes.

The apparatus used for working the Jacquard machinery, shown in Figs 212, 213 and 214, answers the purpose extremely well on this kind of loom. That part of the bar or rod 20, which passes through the warp, should be made flat and with round edges, and well polished, so as to prevent strain or friction on the threads

during the operation of weaving. To prevent confusion, we have not represented in these drawings the jacks or coupers which support the headles *c, c;* but any practical weaver of figured goods, as a matter of course, understands that part of a loòm.

The reader will not fail to perceive, in Fig. 212, a beautiful representation of an embalming scene, as practised by the ancient Egyptians. This operation was performed on those men who had distinguished themselves by their achievements in their country's cause; and, as a further token of respect, sometimes their brains were picked out (as in the present instance) and carefully preserved at the expense of the Government. For the drawing of this remarkable scene, we are indebted to our old friend, Alexis Kersivenus, who informs us, that the dead gentleman, on whose cranium the physicians are at work, was the first person, in Egypt, who succeeded in weaving a correct representation of the twelve signs of the zodiac.

Erastus B. Bigelow, Esq. of Lowell, Mass., obtained a patent, 30th May, 1842, "*for certain improvements in the manner of mounting the harness, and working the same, in the loom for weaving figured fabrics, such as are commonly known under the names of imperial or French quilts, and imperial petticoat robes.*"

The specification of this patent is of enormous length, full of useless repetition, and the figures which accompany it, cover three large sheets of drawing paper. For this specification and drawings if we recollect rightly, we paid the Commissioner of patents (H. L. Ellsworth) at Washington, the sum of $17.50.* The patentee, in summing up his claims, says

"Having thus fully described the nature of my improvements, in the loom for weaving counterpanes, and other figured articles, and having also, set forth several different modifications thereof, and *particularly in the manner of forming and arranging the cams, on the cam shafts,* by which the required motion is given to the respective treadles, so as to correspond in their action with the arrangements made in the other parts of the loom, it is to be understood that *I do not claim, nor do I intend to limit myself to the particular arrangement of the cams and treadles, these not constituting a distinguishing or an* ESSENTIAL *feature of my im-*

* We did not receive the specification and drawings of this loom in time to insert them in the proper part of this Work; but we expect to have another opportunity soon of laying them before the public.

provements; these consisting mainly, *in the mounting of the loom and of tying up the harness, so as to admit of the employment of one, or more, moveable harness-boards, and of one, or more, leaves of headles, and of the Jacquard Machine in the power loom.* By this arrangement I am enabled to produce a free and open shed of the warp, and to allow one part, or shed, thereof *to descend whilst the other is rising.* What I claim, therefore, as *constituting my inventions*, and which I desire to *secure* by Letters Patent, is the within described manners or modes of mounting the loom, and tying up the harness, and of working the same, in which, under its various modifications, *I combine a moveable harness-board, or boards, with one, or more, leaves of headles, or harness, and with the Jacquard Machine in the power loom,* (see Figs. 212 to 217;) such arrangement and combination being *substantially* the same with that herein described."

The loom represented at Figs. 212 to 217 was patented three years prior to Mr. Bigelow's loom; and the invention of it took place nearly five years before the date of the patent.

The Jacquard machine used by Mr. Bigelow is of the old construction, *having trap-boards and knot-cords;* and the patentee says in his specification, "*One of the trap-boards is allowed to descend whilst the other rises, without disturbing the action of the knot-cords, and I thereby counteract the unequal action of the harness weights upon the cams by which they are raised.*"

This action of the trap-boards is the invention of James Cross, of Paisley, Scotland; and which he first brought into notice about the year 1818; it is known by the name of "Cross's counterpoise harness;" the principle of which is, that *one trap-board rises while the other is sinking.* Mr. Cross's loom is described at page 161, and represented at Figs. 171 to 179; and by examining it attentively, the reader will perceive that the counterpoise trap-boards, on which Mr. Bigelow lays the greatest stress, (in his specification) are there shown to perfection. The raising and lowering of the harness-boards below, so as to govern the shedding of the warps, corresponding to the action of the trap-boards above, is *entirely dependent on the principle* of Mr. Cross's machine. The practical weaver of figured textures, will at once perceive the nature of these claims of Mr. Bigelow.

The patentee describes, at great length, various forms of cams, which are also represented in his drawings; and by means of these cams, he tells us, the necessary motions are communicated to the headles, as well as to the Jacquard. *Twenty* different figures of

these cams are given, illustrative of their various forms and the positions which we are told they assume during the operation of the loom. The cam-wheel for working the Jacquard corresponds in every respect to that marked D' D', in Tompkins and Gilroy's loom, Fig. 205; the cams for working the headles, &c. are also the same.

It will be observed that Mr. Bigelow, in summing up his claims, says, in reference to all these, that they do not constitute "a distinguishing or an *essential* feature" of his improvements, but remarks, that these consist "mainly in the mounting of the loom, and of tying up the harness, so as to admit of the employment of one, or more, moveable harness-boards, and of one, or more, leaves of headles, and of the Jacquard machine in the power loom." (See Gilroy's loom mountings or tie-ups, Examples Nos. 1 to 10.)

It appears somewhat strange to us, that this gentleman should fill three-fourths of his specification in describing these wheels and cams, and give so many different figures of them in his drawings; and after all this state, that they are not "*essential*" to the working of his loom. Now the truth is, without these, the loom would not be worth a stiver, because it could not produce the stuffs referred to in the specification at all, as any one may perceive by looking at the specification and drawings of this patent, lodged at Washington.

It has been already stated, that Mr. Bigelow claims "the employment of *one* or *more* leaves of headles, and of the Jacquard machine in the power loom;" which is funny enough. By reference to Figs. 203 and 204, it will be perceived that Tompkins and Gilroy's loom has *eight* leaves of headles, besides Jacquard machinery; and yet their patent is dated May 9th, 1835, whereas, Mr. Bigelow's is dated May, 1842; (see also Figs. 212, 213, and 214.)

Some men admire the heights of mountains, the huge waves of the sea, the steep fall of rivers, the compass of the ocean, and the circuit of the stars, but as for us, we shall for the present content ourself with simply noticing a loom for weaving coach lace, Brussels carpeting, and other fabrics with looped surfaces invented by Thomas Thompson, a subject of Great Britain, and which invention has been SECURED by Letters Patent. By the aid of this loom, Mr. T. is enabled to manufacture coach lace at the cost of *one penny farthing* per yard, which formerly cost four pence half penny, exhibiting the astounding difference in favour of Mr. Thompson's machine, over every previous machine, of three pence farthing per yard. To this manufacture he has added the Brussels

carpet, velvet, &c., which we are assured is produced with the most surprising velocity. "*It is truly astonishing to see the march of science.*"

Mr. Thompson's ingenious loom is described in the London Journal of Arts and Sciences, conjoined series No. CL. vol. XXIV, and may be procured on application to Messrs. Newton & Son 66 Chancery Lane, London.

As we intend to give a complete description of this machine, in our work on carpet weaving by power, no farther notice need be taken of it in this place.

Miles Berry, (of the firm of Newton and Berry, patent agents, 66 Chancery-lane, London,) obtained a patent in August, 1838, for certain improvements in looms for producing metallic tissues, and also improvements in such tissues, applicable to the making of buttons, epaulettes, tassels, and other purposes, for which gold and silver lace or braiding is commonly employed, and to the making of imitations of jewellery and other fancy articles.

These improvements consist, in weaving or producing ornamental metallic tissues or fabrics of wire applicable to various useful purposes, for which gold and silver lace is commonly used; as for instance, in the making of different articles of ornamental dress, epaulettes, bands, sashes, bindings, trimmings, tassels, buttons, and various other purposes where gold and silver lace is now applied, also to the covering of boxes, books, card cases, and covering or forming various imitations of jewellery, and other fancy articles; and consist in weaving, making, or forming, such ornamental metallic tissues, entirely of strands of wire, either of gold, silver, silver-gilt, copper-gilt or other metal, or mixtures of metal, which wires are woven into a tissue or fabric, having patterns or ornamental devices thereon, by any suitable figuring machinery, such ornamental metallic tissues being composed entirely of metal, in contradistinction to the ordinary gold and silver lace, and have all the variety of design or pattern, and brilliancy of appearance of the finest figured or brocaded silk, or other fabric, without their *perishable* qualities; and are capable of being cleaned by boiling or washing with water, or immersing in acid solution, and gilded or silvered or even soldered together after they have been woven,—which cannot be done with tissues having silk, cotton, or other threads, interwoven in the fabric.

The improvements in the looms for weaving such tissue or fabrics, being the application and adaptation of the well known Jacquard

mechanism or apparatus for acting upon the warp threads or wires, to produce the figure or design, together with suitable mechanism, whereby the same is made or rendered more applicable to the loom for this purpose; for when the Jacquard apparatus is applied in the ordinary manner (in hand looms) the abrupt or sudden action caused by the treadles through the Jacquard upon the warps, and also their great extent of opening or separating to allow the shuttle to pass, is liable to break the metallic strands, they not being so elastic or capable of yielding longitudinally as warps of silk or twisted fibrous material, and therefore a means of remedying this evil is adapted with the Jacquard to the loom; the rising motion of the head-board or top of the Jacquard apparatus, being first met by an elastic resistance, and then stayed at the proper distance by an adjustable stop-piece.

It should be here remarked, that solid gold and silver, and gilt wire, has been heretofore applied in the making of gold and silver lace; but it has only been used as weft threads, interwoven with warps, consisting of threads of silk or fibrous material, such warps being covered, or nearly so, by the picks of metal weft, and having a small or finer binding warp thread of silk or fibrous material to secure such metal weft in parts where it floats over several threads to produce the figure or design on the face of the fabric; and such combination of metal, and silk or fibrous material, has heretofore, only been woven in an ordinary figuring loom without the Jacquard apparatus; such lace has all the disadvantages of the common gold and silver lace, composed entirely of silk or fibrous material, both warp and weft being covered by a thin coating of metal wound or coiled around them. It should also be observed, that a description of metallic tissue has heretofore been woven in ordinary looms of the simplest construction, that is, without the means of producing figures or designs: but this has been done only in broad-pieces of plain fabric, the warp and weft regularly interweaving with one another at each pick of the weft or change of the pattern or figure; which woven *wire work* or fabric is applicable to the making of window-blinds, paper strainers, sieves, screens, fire guards, and other purposes, where the same may be used.

In order to apply this invention with good effect, and produce the ornamental tissues with the best advantage, the metallic strands or wire should be carefully annealed by heating the same, and allowing it to cool gradually, in order to destroy the brittleness caused in the drawing of the wire, and to render it as pliant as possible, so that the metallic strands may work well with the Jacquard appara-

tus. The following means or method of effecting this object should be pursued:—

The wire is first wound upon hollow metal bobbins; into the hollow part or centre of these bobbins are to be placed red hot pieces of metal, whereby the wire will be heated on the bobbins, and then allowed gradually to get cold. In order to preserve the polish of the wire, and not to injure its colour, the bobbins should be of different metals, according to the different metal wire to be operated upon; for instance, when copper wire is to be used, the bobbin should be formed of copper; if the wire is silver, or silver gilt, or copper gilt, the bobbin should be formed of *silver*, and if the wire is gold, the bobbins should of course also be of *gold.** This process of annealing, as well as the means employed, may be varied according to circumstances, and the kind of metal to be operated upon; or the wire or metallic strands may be annealed in any other convenient way; but the above described process prevents the wire being injured by heat, and gives it all the pliancy desired.

First, begin by warping the annealed metallic strands or wires, by six at a time, on the ordinary warping mill, each wire being supplied from a bobbin, placed on a creel in the same manner as in the ordinary method of warping cotton, silk, or other threads, (see Figs. 3, 4 and 5.) These metallic strands are to be fastened, by packs of 25 together, on the warp beam of the loom, taking care they are all equally distended. When this is done, the beam is to be turned round, and all the warp threads wound evenly thereon. It is requisite, at each revolution of the roller, to place a strip of card-board, or piece of stiff paper or other material, upon the metallic strands, wound upon the beam, in order to prevent them from getting entangled one with the other; or a continuous sheet of card-board, paper, or cloth, may be wound on with the strands for this purpose. This precaution is very necessary, as otherwise the threads would bind one with another, and prevent them unwinding or drawing off regularly, during the operation of weaving, and thereby become broken. A sufficient length of the metallic warp must be left unwound, to allow of their being passed through the headles and the reed:—this is done in the same way as with cotton or silk warps: the workman, however, must be careful not to let any of the strands escape; for, if he does so, the wire springing back would coil up on itself, and loop into a kind of knot,—and consequently

* None but workmen of the best character are employed in this manufacture, strict honesty being indispensable.

be injured. When this is the case, the injured wire must be replaced by another, to be taken from an extra spool or bobbin placed at the back of the loom; and every time a metallic strand breaks, during the weaving of the tissue, it must be replaced by a fresh one, taken from an extra bobbin, and the part of the broken strand remaining on the warp beam conducted out of the way by passing it over a small pulley, and kept, by means of a weight attached to it, from intermixing with the other or perfect threads. When all the threads are passed through the headles and the reed, they are to be collected, in packs of 25, and fastened to the cloth roller, the strands being distended equally thereon. These preliminary operations being performed, the loom is ready for working.

The shuttle employed is similar to that used in the weaving of silk, and is supplied with a bobbin containing the metallic weft strands. The shuttle should, however, be rather heavy, as instead of governing the delivery of the weft, it would then be governed by it, and would spring back and cause injury to the work. The first few courses of the shuttle serve to regulate the position of the threads, as in ordinary weaving, and for that purpose any kind of weft may be used instead of metallic wires.

The operation of weaving is effected in precisely the same way as when working with silk or other material: care should, however, be taken that the weft strands of wire be finer than those of the warp.

Tissues, composed of copper wire, may be woven in their natural colour, and afterwards gilded or silvered; or this may be done previous to the weaving, as thought desirable.

Silver tissue requires much less care in the course of fabrication than wire gilt or silvered, as with the latter, care must be taken not to injure the surface; the tissue, as it is woven, should be covered with a cloth.

These metallic tissues may be applied to a great variety of articles and purposes, and, by their being composed entirely of metal, may be cut into any number of parts or forms, and attached to each other, or to other metal pieces, by soldering, or by the usual mode of joining various articles of jewellery and fancy work. They may be used for the top parts and binding of epaulettes, where gold and silver lace is now employed; for covering the heads of tassels; covering buttons; and various fancy articles; and when woven in narrow breadths, after the manner of gold and silver lace, galloons, or binding, they may be used for hat and other bands, bindings and trimmings for various purposes.

The metallic tissues, composed of silver wire, are very readily cleaned with a solution of water and sulphuric acid—the strength or portion of acid is regulated according to the degree of oxidation of the metallic tissues; or they may be cleaned in any other way that delicate metal articles are usually cleaned. Those articles which have become discoloured by exposure to the atmosphere, the effect of smoke, or other causes, may be dipped in acid solution, and their primitive freshness restored.

Glass Weaving.—M. Dubus Bonnel, of Lille, has discovered a method of making a cloth of glass, which is perfectly flexible, and may be applied to the hanging of rooms and other purposes. This cloth is extremely beautiful; and from the manner in which it reflects the light, it surpasses in brilliancy every thing that has ever been attempted with silk, even when combined with gold and silver. Some specimens of this new manufacture have been exhibited in the Passage de l'Opera, in Paris; and the Queen of the French was so pleased with them, that she ordered a gold medal to be sent to the inventor. The following passage is extracted from a French paper:—"When we figure to ourselves an apartment decorated with cloth of glass, and resplendent with lights, we must be convinced that it will equal in brilliancy all that it is possible for the imagination to conceive; it will realize, in a word, the wonders of the enchanted palaces of the *Arabian Tales.* The lights flashing from the polished surface of the glass, to which any colours or shade may be given, will make the room have the appearance of an apartment of pearls, mother-of-pearl, or diamonds, or composed of garnets, sapphires, topazes, rubies, emeralds, amethysts, &c., or, in short, of all those precious stones united and combined in a thousand ways, and formed into stars, rosettes, boquets, garlands, festoons, and graceful undulations, varied almost to infinity."—*L'Echo du Monde Savant, &c. No.* 58, *Feb.* 15, 1837.)

The warp is composed of silk, and forms the body and groundwork, on which the pattern in glass appears, as effected by the weft. The requisite flexibility of glass thread for manufacturing purposes is to be ascribed to its extreme fineness, as not less than 50 or 60 of the original threads (produced by steam-engine power) are required to form one thread of the weft. The process is slow; as not more than a yard can be manufactured in 12 hours. The work, however, as already observed, is extremely beautiful, and comparatively cheap, inasmuch as no similar stuff where bullion is really introduced can be purchased for any thing like the price at which this is sold; added to this, it is, as far as the glass is concerned, im-

perishable. Glass is more durable than either gold or silver, and, besides, possesses the advantage of never tarnishing. Some admirable specimens of this kind of cloth may also be seen at the Polytechnic Institution, Regent street, London, especially two patterns of silver on a blue and red ground, and another of gold on crimson.* The Jacquard by which it is woven may also be seen at the same establishment;—this Jacquard is *exactly* like that represented at Figs. 93 to 98, and described at page 192.

The inventor of this manufacture (M. Bonnel) entered into an arrangement with Colonel Calvert, of London, for the purpose of securing patents in Great Britain, for the method of rendering the glass thread pliable, as well as of giving it any shade of colour required. The Colonel obtained patents accordingly in the year 1837, and soon after applied to us for an introduction to a person likely to purchase them, and also to construct a few looms, for the purpose of exhibiting the new manufacture on a small scale in the first instance, to show the advantages of it. We immediately introduced him to Mr. William Webb (of the firm of James Jacquier & Co., loom-builders, No. 1, Wood street, cor. of Church, Spitalfields.) This gentleman, having the entire confidence of the English manufacturers, both as regards strict integrity of character and as possessing a thorough practical knowledge of every species of figured weaving, was, in a short time, enabled to meet the Colonel's wishes. Mr. Williams offered to purchase the patents, provided that Mr. Webb would undertake to fit up suitable looms for weaving the stuff, which the last named gentleman agreed to do; and accordingly the patents were purchased from the Colonel for 5000*l*. For our trouble in this affair, and many other services besides, we have never received from the Colonel so much as a polite acknowledgement. Had we not signed the "temperance pledge" we might have insisted on something to drink. Mr. Webb, for his services, obtained the sum of 5*l*.; while his lost time was at least worth 100*l*.

Letters patent were granted to us in England, Ireland, Scotland, France, Belgium, Prussia and the United States of America, for a loom for weaving figured goods of almost every description, on the full harness principle without either headles or treadles. The English patent bears date 12th May, 1839, and was enrolled in Her Majesty's High Court of Chancery, Chancery lane, London, 12th

* Some beautiful specimens of this kind of cloth have lately been presented to the Commissioner of Patents at Washington, for public exhibition in the Patent Office in that city.

Fig. 218.

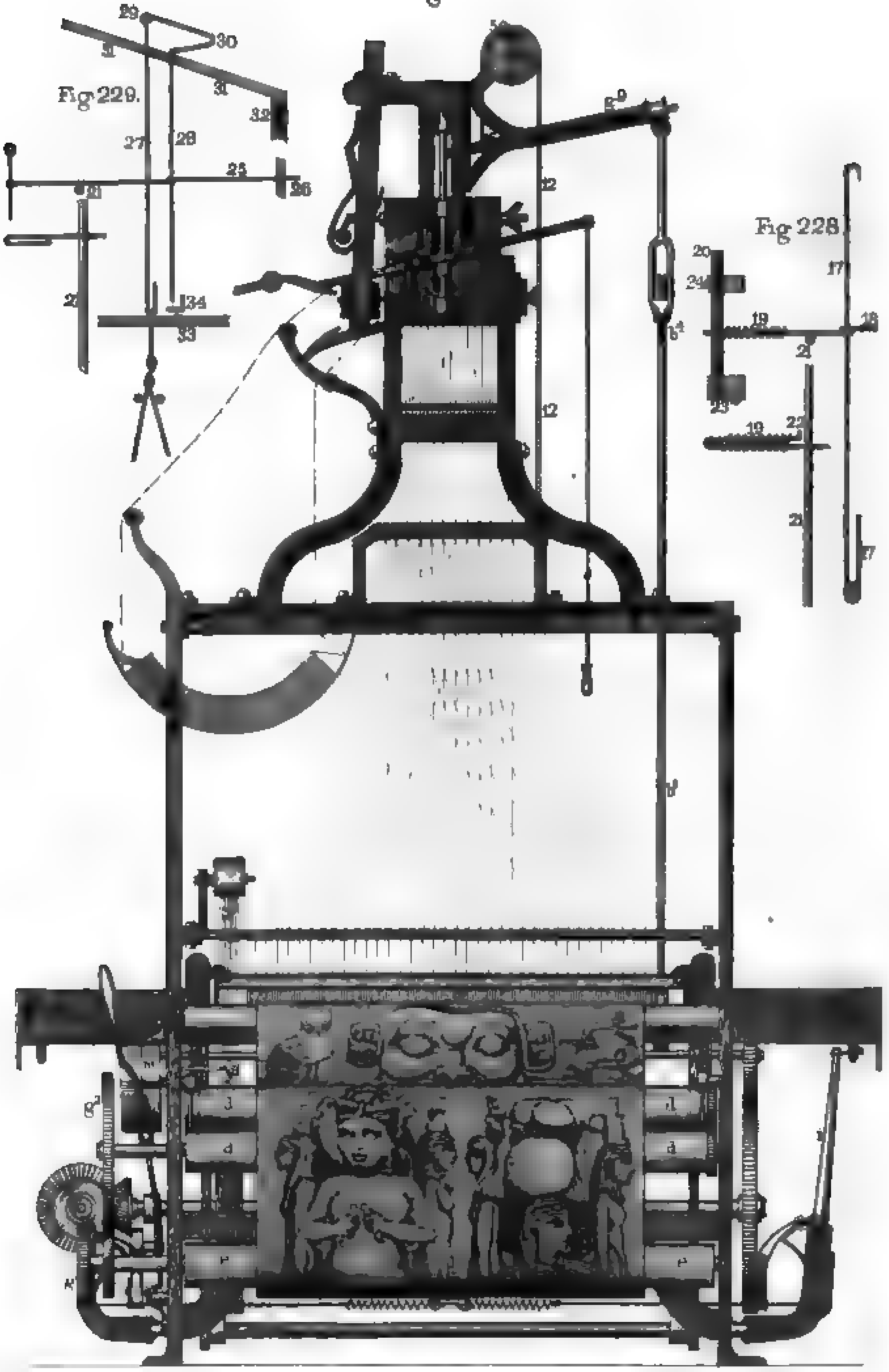


Fig 219.
Fig 224.
Fig 226.
Fig 219a.

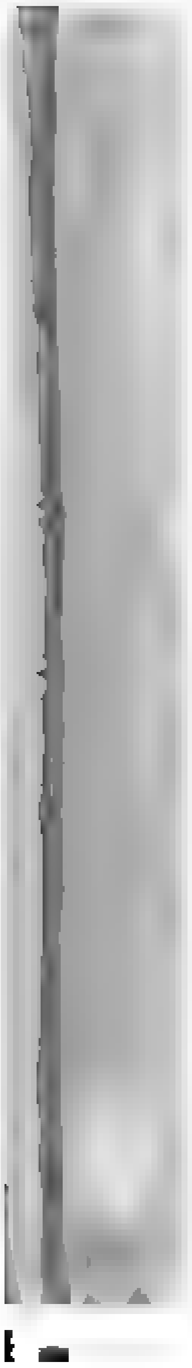


Fig. 220.

Fig. 223

Fig. 225

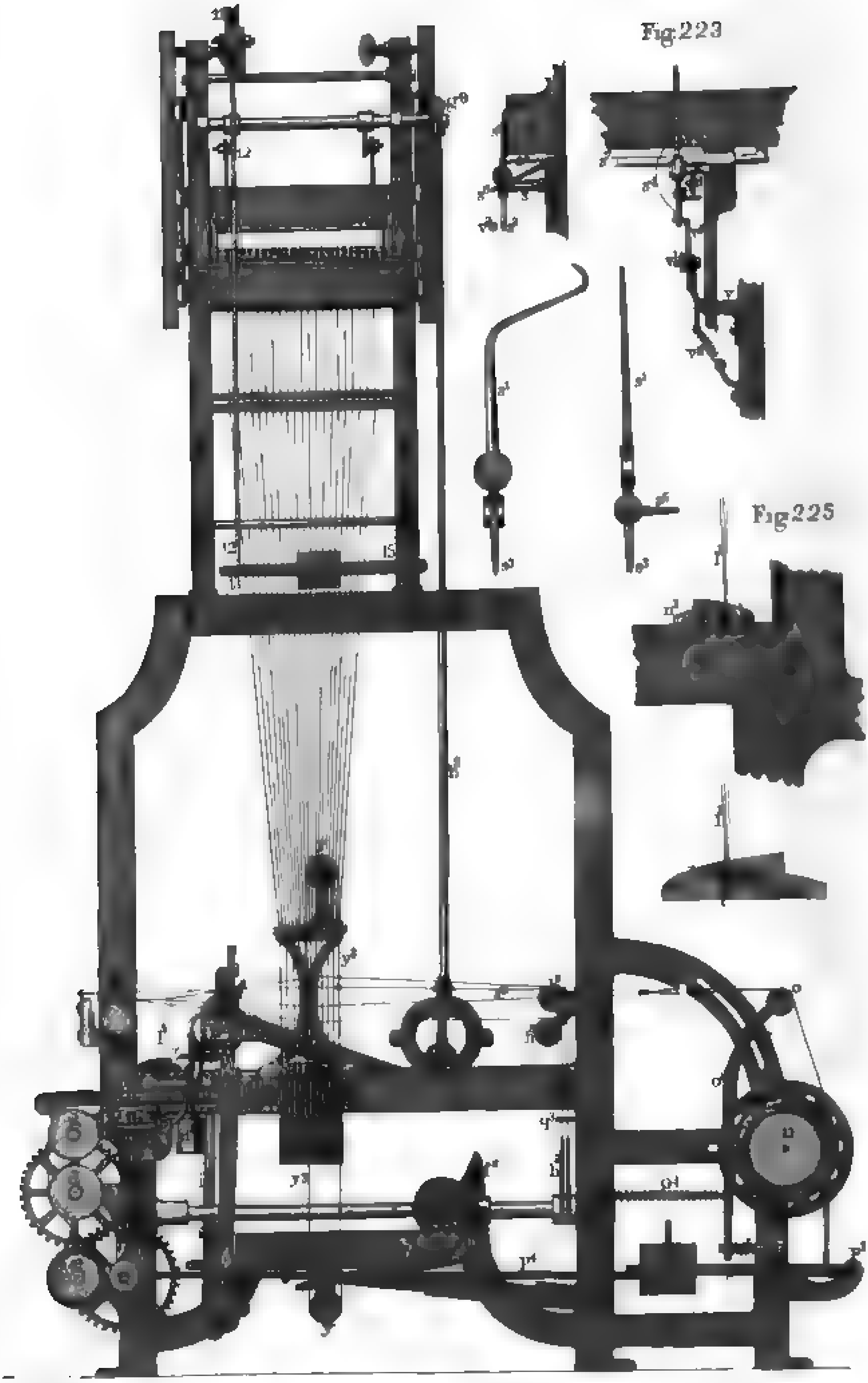


Fig. 227.

Fig. 222a.

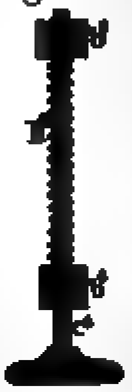
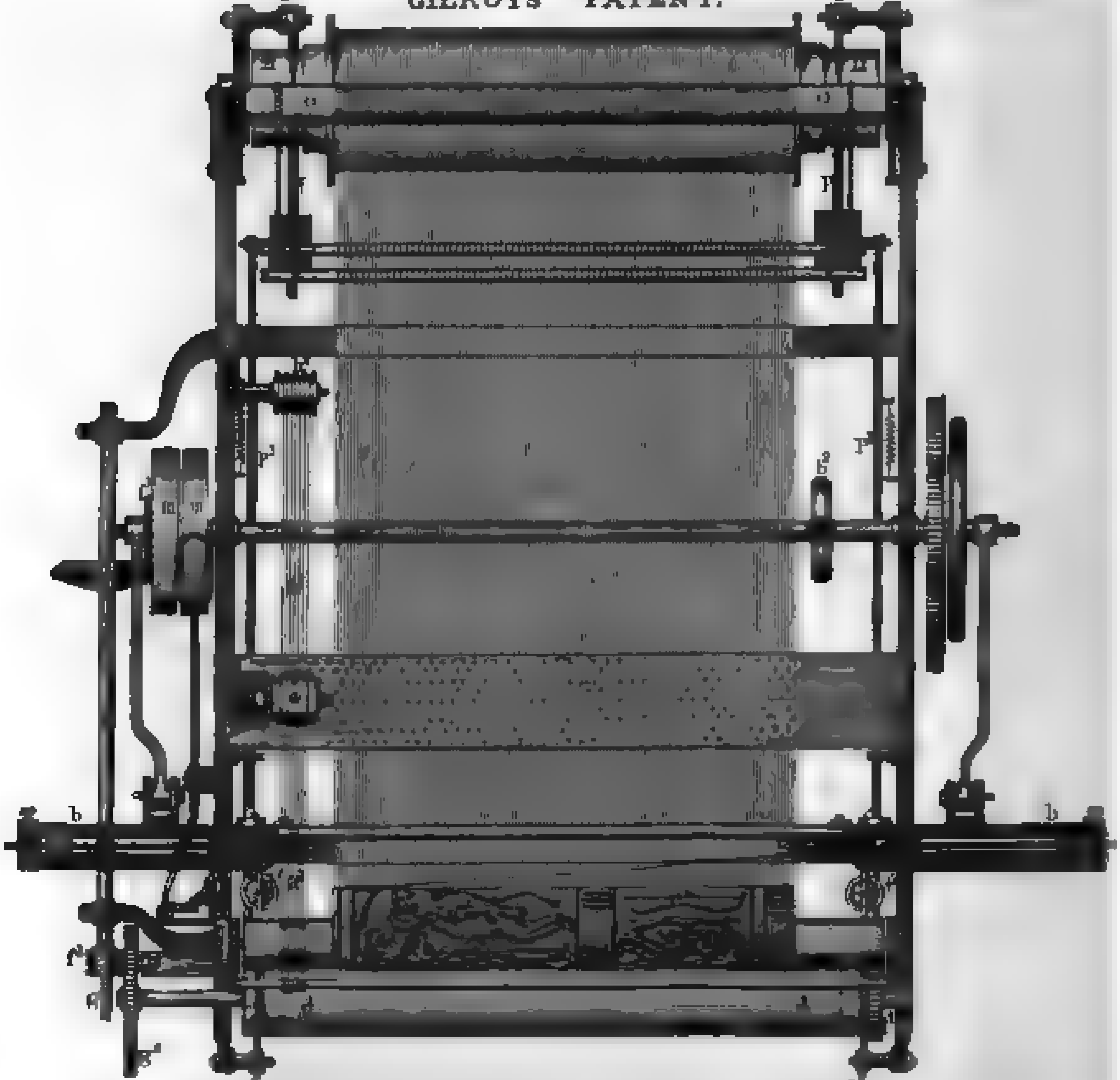


Fig. 222.

Fig. 221.
GILROYS PATENT.



November, in the same year. The English, Irish, and Scotch patents are in the name of Moses Poole, Esq., (of the firm of Poole and Carpmael, of the Patent Office, London;) the French in the name of Charles Cunningham, Esq. (father-in-law of Charles Lafitte, of the firm of Lafitte, Blount & Co., bankers, Paris;) the Belgian in the name of Henry Truffaut; the Prussian in the name of Platzhoff and Haenal, silk manufacturers, Bruggen, near Crefeld; and the American in the name of Jeremiah Wilbur, Esq.* (of the firm of Masters, Markoe & Co., merchants, New York.) The last named patent is dated March 12th, 1842, but has only 14 years to run from the date of the English one above named.

Fig. 218, represents a front elevation of this improved loom.

Fig. 219, a side elevation.

Fig. 220, a longitudinal vertical section.

Fig. 221, a plan of a part of the loom.

Fig. 222, a front view of the Jacquard cylinder and frame which carries it, showing the card protectors.

Fig. 223, is a detached section of the lay, &c., showing a front and side view of the weft puller or tightener.

Fig. 224, shuttle.

Fig. 225, the slide of the stop motion detached.

On the different Figs. of these drawings, the letters of reference are the same.

a a, the frame of the loom; *b*, the lay; *c*, (Fig. 218) the reed. The take-up motion rollers *d d*, placed one above the other just under the breast-beam, are geared together by the cog wheels d^1, (Fig. 218;) the upper take-up roller is pressed down by a lever and weight d^3, (Figs. 219, 220 and 221;) on the axis of the lower one is a pulley d^2, (Fig. 219) from which a band or belt e^3, passes down to a simliar pulley e^2, on the cloth roller *e*, (Fig. 220;) this band is tightened with more or less force by the pressure of the pulley e^1, (Fig. 219) attached by a stud to a bent lever e^5, governed by a moveable weight. *f*, (Figs. 220 and 221) is a horizontal shaft on the outside of the frame, placed at right angles to, and on a level with the cam shaft, on the end of which is a bevel wheel f^1, (Figs. 218 and 221) meshing into the bevel wheel f^2, on the shaft *f*, (it will be perceived that by changing the relative size of these wheels different relative velocities will be given to the shafts;) on the for-

* George D. Baldwin, merchant, 35 Spruce-street, New York, has the sole management of our patents in the United States of America; to whom *all communications* on the subject must be addressed.

ward end of the shaft *f*, is a worm wheel f^3, (Fig. 221) working into a stud-wheel *g*, on which is a pinion g^1, meshing into a cog-wheel g^2, on the axis of the lower take-up roller *d*. *i i*, are picker sticks; *j*, (Fig. 219) are the shuttle-levers or treadles, by which the picker-sticks *i i*, are moved; *k*, are the cams to put the shuttle-levers in motion (one at each side of the loom;) *m*, fast and loose pulleys driven by a belt in the usual way; *n*, warp beam; *o*, whip-roller—this roller is suspended on the top of two levers o^1, having their fulcra at o^2, (Figs. 219 and 220) and extending down nearly perpendicular; the ends of these levers rest against tops o^3, and are held there by springs o^4; this allows the warp to give way at every beat of the lay, recovering its first position when the lay retires from the cloth. The warp-beam *n*, is surrounded at each end by the usual friction strap, to each of which is appended a lever *p*, having its fulcrum at p^1, and running under the warp-beam towards the front of the loom; on this lever is a sliding weight p^2, to which is attached a connecting rod p^3; these rods have eyes in their forward ends, in which the journals of a horizontal roller *q*, turn; p^5, (see Fig. 221) are springs attached to the rods p^3, which draw them forward and bring the roller *q*, against the cloth roller *e*, and the weight p^2, to the extreme end of the lever. The warp yarn runs from the beam *n*, over the roller *o*, through the harness and reed over the breast-beam (which in this loom is a roller, as shown in the Figs;) the cloth then passes down inside and under the rollers *d d*, and round the lower one, up between, then over the upper one and down to the cloth roller *e*, (this roller is clearly shown in Fig. 220.) As the cloth roller increases in size by the winding on of the cloth, the roller *q*, is pushed back, carrying along with it the rod p^2, and weight p^3, thereby lessening the tension on the warp-beam, as the roll diminishes; on taking a "cut" from the cloth roller the rod p^3, is lengthened by means of the coupling at p^4, (Fig. 220) so as to retain the weight in the same position when the cloth is taken from the roller; the cloth is regularly drawn forward as it is woven, by means of the take-up rollers, connected as above described, with the cam shaft; the cloth is wound on the cloth roller *e*, with any required degree of tension, as fast as it is delivered from the take-up rollers *d d*, by means of the band or belt e^3, and tightening or friction pulley e^1, the revolutions of this roller being regulated by the quantity of cloth given out. On the driving shaft *r*, (Fig. 221) is placed an eccentric b^2, surrounded by a collar to which an inflexible rod b^3, is attached, having a governing screw b^4 (Fig. 218) to regulate its length; the upper end of this rod is

connected with the Jacquard lever g^9. It will be perceived by this arrangement that the harness leads, weights, &c., are worked with the greatest precision and without shock; but, as the shed in this case closes down, when the lay has been brought forward half the beat, the eccentric above described could not be used on some kinds of textures to advantage, particularly on silk goods, but for another invention which we call the "weft puller" or "tightener," constructed in the following manner:—To the under side of the lay is attached an iron s, (Fig. 223) which projects forward and is formed into a fulcrum, on which turns a finger or lever s^1; this finger runs up in front of the lay, and curves back lying in a channel cut across the race-board, (one channel outside of each selvage) the extreme end curving up, at or behind the reed; the finger is held in this position by a spring s^2, (Fig. 223) attached thereto above the fulcrum, and passing under the lay; the end of the finger below the fulcrum is flattened out, and a short rod s^3, is joined to it (forming a hinge) so as to vibrate sideways parallel to the lay; this is kept in a vertical position by the spring s^4; from the opposite side projects a stud s^5 on which an arm s^6, from the protector s^7, of the stop motion rests (this is connected with the shuttle-box and is of the common construction, as shown in Figs. 219 and 220;) from the front upright of the loom is extended out an arm v, (Figs. 220; and 223) under the breast beam, the end of which forms a fulcrum at v^1, for the lever catch v^2 (Fig. 223;) this lever, at its lower and forward end, is bent so as to rest on the arm v, and is held down to it by the spring v^3; the other end of this lever is bent up so as to come in contact with the rod s^3, when the lay is thrown forward, carrying the finger or lever s^1, forward of the lay, and pushing the weft thread up to the cloth and straightening it before the shed descends; as soon as the rod passes over the catch, the spring s^2, (Fig. 223) brings it into place again, as the lay returns, the lever v^2, is depressed by the rod s^3, till it clears it:—if the shuttle does not pass entirely into the box, the rod s^6 (which is secured in the protector s^7,) bears down on the stud s^5, and turns the rod s^3, to one side, so that it does not strike the lever catch v^2, and the finger s^1, remains at rest till the loom stops, thereby preventing the damage that might be caused by forcing it forward.

The Jacquard in its general construction is similar to that represented at Figs. 93 to 98, and described at page 192, except in the following particulars: The first part of the improvements consist in what we call "card protectors." Fig. 222 shows a front view of the cylinder z, with its pattern cards, (these cards are like those re-

presented at Fig. 97,) and the frame b^6, which supports it. The card protectors (one at each end of the pattern card) are marked c^6, and are similar to the press d^6; they are placed $\frac{1}{4}$ of an inch inside the studs or knobs a^6; the feet of these protectors have a smooth wire on their under edge, (see detached part, Fig. 222½) to prevent the cards from catching: the rods of these protectors run up through the cross braces b^6, of the cylinder frame, passing through spiral springs h^6 between the braces which help to press them down on the pattern-card. It will be seen that by this simple method the cards are prevented from being misplaced or injured when the loom is in the most rapid motion.

The second improvement in the Jacquard consists, in a method of counterbalancing the leads, so that a great saving of power is obtained in working the loom; this improvement is shown in Figs. 218, 219 and 220. 11, is a throated pulley which revolves on its axis in a suitable stand, bolted to the frame of the machine at the top; 12, is a strong rope made fast to this pulley 11, and passing out at one side of it, where a knot is made upon the rope; this knot is represented at 50, Fig. 218; one end of the rope is then connected to the Jacquard lifting arm at 16, the other end being made fast to a lever 13, (Figs. 219 and 220;) this lever has its fulcrum or axis at 15, and is governed by the counterpoise 14, which may be regulated to any required position by means of a set screw, as shown in Figs. 219 and 220: the operation of this apparatus is as follows: When the loom is put in action, the rod b^3, Fig. 218, will cause the end 16, of the Jacquard lifting arm to be elevated and thus allow the lever 13, to be depressed by the counterpoise 14; this takes place at each vibration of the lay, while the shed is opening; and while the shed is closing, this lever will again recover its first position, as shown in the Figs. While the shed is opening, the weight 14, on the lever 13, will aid the belt or strap, which communicates motion to the machinery (in the usual way) in lifting the leads, because it will act as a counterpoise upon them. By a proper adjustment of the weight 14, according to the weight of lead required to be lifted, the belt for running the loom on light goods, such as merinoes, gros de Naples, &c., need not be over 1¾ inches wide; we have never used a broader one on such goods; any sudden jerking, caused by the leads in their descent, will be entirely prevented by the counterpoise 14. By means of this contrivance, it will be perceived, that the power required to drive the loom is but small, not more than one-third as much as in ordinary power looms. To some *very learned* gentlemen, this apparatus may appear, from

its extreme simplicity, as unworthy of notice; but if they cannot see through it *theoretically* they would do well to try its effects in *practice*.

The third improvement in the Jacquard is shown at Fig. 228, and consists in placing the spring 19, *on* the needle, instead of at the back of it, (as at c^2, Fig. 98.) In Fig. 228, 17, 17, represents the common lifting hook; 18, the needle; 19, the spring; 20, a wire or reed dent, inserted in the double of the needle, outside the spring; 21, the horizontal wire which supports the row of needles (as at $G^2 G^2$, Fig. 95;) 22, a turned-up lip on the needle against which one end of the spring 19, bears, the other end bearing against the dent 20; 23, a small triangular piece, screwed against the bottom of the needle frame, to support the dents 20, and keep them from dropping through; this piece may either be made of wood or iron; there is also a small straight edge 24, screwed against the frame above, for the purpose of keeping the dents 20, in their proper place; these dents are let into small notches or cuts, made with a saw in the back of the frame, which notches should be rather larger than the thickness of the dent, in order that the dent may be easily drawn out when required. Now, it is evident, that by pressing back the point 18, of the needle, the spring 19, will be compressed between the dent 20, and turned-up lip 22, and when the pressure is removed, the needle will instantly recover its former position, as shown in Fig. 228. By this improvement, the pattern produced on the cloth will be more perfect than in looms where a spring-box is used, such, for instance, as that shown at $Z' Z'$, Fig. 96; because, when the springs are placed on the needle, they do not require to be of more than half the strength of those used in a wooden box, for the following reasons: Firstly, when the spring is placed on the needle, as in Fig. 228, changes in the atmosphere will have no detrimental effect upon it such as they have on the springs A^2, placed in the box Z', Fig. 96, these being liable, when compressed, to stick or catch on the fibres of the wood in the holes of the spring-box, in which case the needles would not be driven up against the card, and the warp threads which the needles governed would not be lifted; consequently the pattern would be produced imperfectly upon the cloth. In working with the spring-box, it often occurs that as many as five or six springs stick in their holes at once, particularly in damp weather; secondly, when the springs are placed on the needles as shown at Fig. 228, they may be made of brass wire as fine as No. 28, whereas, with the spring-box they must be of No. 23 or 24, and even then their action is not near so

certain as in the former instance. We have worked a power loom like that shown at Figs. 218 to 221, upwards of six years, on *silk* goods, at a speed of from 110 to 120 picks of weft per minute, with springs of the description shown at Fig. 228, and we can truly say, that we never observed a single instance of a needle sticking back, or of a thread being misplaced in the pattern occasioned by any fault in the operation of the springs; these springs should be two inches long and $\frac{3}{16}$ of an inch in diameter. When the spring is placed at the back of the needle, (as shown at Figs. 96 and 98,) it sometimes expands so as to become larger than the doubled end of the needle; and when this occurs, it will partly slip on the needle at every change of the pattern, and thereby prevent the proper operation of the needle. We think it will now be seen, that our improvements on the Jacquard, just described, obviate several very serious defects.

In a shuttle of the ordinary construction (see Fig. 224) is attached a brush, or tuft of hair, or similar fibrous material h^5, on one side just under the bobbin, or quill i^5; which brush, pressing against the bobbin, prevents the thread from coming off in loops or kinks. There is also affixed a small pin m^5, in the side of the shuttle against which the bent wire n^5, is pressed by the spring o^5, the pivot or axis being at p^6; the weft thread, after unwinding from the bobbin, passes between the bent wire n^5, and pin m^5, giving it the tension required, which may be regulated by the curve of the spring o^5; it then passes out of the shuttle through the eye in the usual way.

Near the axis of the picker-sticks, is attached to the journal of the lay an adjustable iron i^7, (Fig. 219) with bolts, so as to allow its position to be changed, the upper end being bent horizontal; this rises above the fulcrum of the picker stick, which strikes against it, and stops the picker at any desired distance from the end of the shuttle-box, which prevents the rebounding of the shuttle and stopping the loom.

The manner of stopping the loom when the weft thread breaks is as follows:—Two pulleys y, (see Figs. 218 and 220) are affixed, one over the harness-board, the other just below the lower cross-bar of the loom; around each of these pulleys is passed a short leather strap, and their ends are connected together by the headles or strings y^2; to the front of the lower strap is fastened one end of a bent lever w, (Fig. 220) the fulcrum of which is nearly under the lower or cam shaft, the other end extends up above the cam shaft, on which and in contact with the lever, is placed a tappet z^1. a^2,

(Figs. 220 and 221) is a series of strings fastened into an iron screwed to the guard-board in front of the breast beam (Fig. 220;) these pass through suitable dents in the reed and over the race-board, which is here cut out (see detached parts of lay, &c., Fig. 223) so that the shuttle will pass over the strings without rubbing them, thence through the mails in the headles y^3, one half going into the front or lower mails and the other half into the back ones, as in drawing the warp of a plain web with two leaves of headles; they are then extended over two grooved pulleys h^8, (Figs. 220 and 221,) placed one above the other, so that all the strings which are kept separate by the grooves on the pulleys shall be entirely clear from each other, and passing down through a plate q^3, (Fig. 220) are each attached to a separate lead weight h^8; they are thus prevented from twisting and entangling.

On the protector n^1, of the common stop motion, is formed a notch n^2, (see detached part, Fig. 219½,) and to the slide n^3, (Fig. 225,) constructed in the usual way, for throwing off the shipper, is attached a button l, so as to vibrate easily; from this button is extended an arm l^1, under the strings a^8, having an eye in its end; to each of the lower strings is connected a small thread or wire l^3, the lower ends of which are fastened into the eye of the arm l^1; over the button l, is a sweep l^2, (Fig. 225) made in the slide-piece n^3, which prevents the button from being lifted too high when in action. It will be perceived, that as the cam z^1, (Fig. 220) revolves, it throws back the upper end of the bent lever w, and raises the other end, which is united at the bottom to the strap connecting the headles y^3, causing the front ones to ascend and the rear ones to descend, thus reversing the position of the strings. By this action the button l, will be raised above the slide n^3, (see detached part of protector, Fig. 219½,) so as to be struck by the protector n^1, and throw off the shipper: but while the weft thread is unexpended, or unbroken, it will lie across the lower strings, intercept their rising above the upper ones, and thus prevent the button l, from coming in contact with the protector.

Fig. 227, represents an improved method of working the Jacquard, which we have found very advantageous in weaving heavy goods with warps of a sticky nature, whether of silk or wool. The object of this contrivance is, to hold open the shed until the reed comes in contact with the fell of the cloth. The cam 9, is placed on the crank shaft (instead of the eccentric b^3, as in Fig. 221;) and it is surrounded by a fork-piece 7, 7, carrying two small rollers or pulleys 8, 8; this fork-piece has its fulcrum at 10, where it works on

an axis-pin, fixed on the framing of the loom (Fig. 219;) the cam 9, is divided off by lines, as shown in Fig. 227, and is so arranged that the distance between the points 11, is exactly the same as that between the points 22, 33, 44, &c. From this it is evident, that although the cam 9, is longer one way than another, yet it will work freely between the rollers 8, 8, and in contact with them: for example, the width of the cam on the perpendicular line (drawn across the centre of the rollers 8, 8,) is precisely the same as that between the points 11, 22, and so forth. Supposing, for example, the cam were turned round until the one point 4, came directly under the upper roller, the opposite point 4, on the same line, would be brought directly above the centre of the other roller. Now, had not the cam this shape, the rollers 8, 8, would not bear uniformly upon its circumference, but would allow the under roller to fall away from it at intervals until a fuller part came into action against the roller; the the result of which would be an imperfect shed, and a continual clitter-clatter. It is unnecessary to say more on this subject, as any practical manufacturer or loom builder will easily understand the improved mechanism, and its mode of operation.

The improvements just described, and which are claimed in the patents are as follow:—

Firstly, the combination formed by the rollers *d d*, (as shown clearly in Figs. 218 and 220) and the cloth roller *e*, having the pulleys d^2, and e^2, and their axes (see Fig. 219,) connected by the belt e^3, in combination with the bent lever e^5, having the governing weight, for the purpose described.

Secondly, the roller *q*, and rods p^3, connected to and in combination with the weigths p^2, sliding on the lever *p*, of the drag or friction strap, for the purpose of regulating the tension on the warp beam as set forth.

Thirdly, the weft pullers or tighteners, for drawing forward and straightening the thread or threads of weft, whereby the slack or loose part of each thread of weft is tightened or pulled up immediately after the shuttle passes through the shed, and the bad effect arising from the diagonal line of each weft thread, after the shuttle is propelled through the shed, is prevented; and in combination therewith the eccentric b^2, connected with the Jacquard by an inflexible rod b^3, for the purpose described.

Fourthly, the application and arrangement called card protectors, shown in Fig. 222, for preventing the cards from being torn or damaged during the working of the loom.

Fifthly, in the shuttle, the bent wire n^5, acted on by the spring

o^5, in combination with the brush, or tuft of hair h^5, for regulating the delivery of the weft thread from the shuttle.

Sixthly, the regulating iron i^7, (Fig. 219) in combination with the picker-sticks *i i*, for the purpose described.

Seventhly, the placing of the springs 19 (Fig. 228,) on the needles of the Jacquard, as described, instead of in a box at the back of the needles, as in Fig. 96.

Eighthly, in the motion to stop the loom when the weft thread breaks or becomes expended in the shuttle, the button *l*, attached to the slide n^3, with its sweep l^2, and arm l', to and combined with the lower strings a^3, as described, and set forth in the Figs.

Lastly, the arrangement of mechanism for working the Jacquard, as herein above set forth, and as shown at Fig. 227.

M M. Dohmme and Romagney, of Paris, obtained patents in France and Great Britain in the year 1837, for what they call, an improvement in the Jacquard, the object of which is to supersede the springs, spring-box, &c., at the back of the needles. In order to accomplish this, the patentees construct the vertical or lifting wires of two pieces, as in Fig. 229; that marked 28, passes through the eye of the horizontal needle, and has a bend or hip 30, at its upper end by which it is supported on the top board 31. On the end of this bent part 30, an eye 29 is formed, into which the piece or leg 27, is linked, which thence descends to the bottom board 33, where it is connected to the harness. 25, represents a needle, which is of the common form; and 26, the needle-board, against which the cylinder plays. The bend 30, constitutes a spring-lever, and is a substitute for the spring at the back of the needle shown at Fig. 98; the weight of the leads below, pulling down the eye of the bend 30, on the leg 28, serves to keep the needle 25, pressed against the pattern card. 32, represents part of the Jacquard framing to which the top board 31, is bolted, at each corner of the machine; 21, the horizontal wire which supports the row of needles at the back in the usual way—only one needle, with its lifting apparatus, is shown in the Fig. It will now be evident, that if the triangular lifter 34, is elevated, the leg 28, will also be raised, carrying up with it the leg 27; and by the action of the pattern-card against the point of the needle 25, the lower extremity of the leg 28, will be thrown off the lifter 34, and the needle will be missed. The under lip of the lifter is about ½ inch in width, and is a little elevated at its edge, to prevent the legs 28, from slipping off while being raised; the back or vertical part of the lifter is about an inch in depth. The lifters are made of strong sheet-iron. and are riveted at their ex-

tremities into suitable end pieces, forming a frame or griff. When the loom is at rest, as in the Fig., the lifters should be ⅝ of an inch below the points of the legs 28. The board 21, is inclined to suit the height of each row of needles, in order to prevent the vertical wires or legs 28, which pass through the upper needles, from being thrown farther back at the bottom than those which pass through the under needles.

A committee of the "Société d' Encouragement pour l'Industrie Nationale," including M. le Baron Seguier, waited on the patentees of the above invention at their machine shop, Faub. Poissonniére, Paris, for the purpose of examining four Jacquards on this principle, in operation on vesting stuffs; and the result of the examination was, the presentation, by the wise-heads of the Société, of their large gold medal to MM. Dohmme and Romagney. The committee also drew up a long account, showing forth the advantages of the invention, not only to individuals, but in a national point of view; they likewise set forth its applicability to power-looms, showing that the manufacturer might by this means be enabled to produce figured goods of the most beautiful descriptions imaginable, either of silk, wool, cotton, or linen, and with as much facility as the common brown sheeting which costs only 8¾ sous a yard. The committee thought that a power-loom having a Jacquard filled with these double or two-legged lifting wires, might be driven at a speed of from 300 to 569 picks of weft per minute; and they were also of opinion that a little girl of 19 years of age, or any inexperienced individual, could easily tend 20 or 30 of such looms, each giving out the splendid textures like *water falling from a mountain torrent!** The report of the committee formed a pamphlet of some 60 pages, independent of the drawings accompanying it, the whole being, perhaps, one of the clearest expositions ever given to the world of so obscure a subject, and well calculated to show the unfathomable depth to which human wisdom can dive.

Immediately after Messrs. Dohmme and Romagney obtained their gold medal, and the Report of the committee, M. Dohmme

* The committee further observed that such was the perfection of this machine, that the pattern-cards might be made of common writing paper, instead of pasteboard. We have tried a card of the description recommended, but only to see it torn in tatters the first rap of the needles against it. We have also tried two thicknesses with no better success; and, for anything we know to the contrary, might have continued to the present time, adding ply after ply, without being able effectually to withstand the shock of the said improved apparatus.

waited upon us, at the establishment of Messrs. Pihet & Co., Avenue Parmentier, Paris, when he insisted upon the immense value of the machine, and wanted us to apply it to our looms, which we there had in operation with Jacquards constructed by M. Dioudonnat, (precisely like that described at page 192.) We disapproved of his views upon the subject, and to show us beyond the possibility of a doubt that *our opinion was erroneous*, he instantly held up before our enraptured eyes the said voluminous Report and the glittering gold medal. Shortly after this we received a visit from M. Alexandre Andelle (member of the Legion of Honor) and several other gentlemen, inviting us to see a few looms in operation with the two-legged lifting wires; with which invitation we readily complied. On our arrival at the manufactory, in the Rue Petrel, we saw eight looms at work on fancy vestings, all mounted with Jacquards upon this plan. After examining these looms, we told the patentees, in the presence of Mr. Andelle and the other gentlemen who accompanied him, that the two-legged lifters would in a short time be numbered among the things that were; and at the same time we pointed out the defects of the plan. All this, however, did not seem to damp Mr. Dohmme's ardour, until we passed our hand along the under side of the cloth, bringing the nails (which were at the time of considerable length) in contact with it, and drawing the hand gently forward; by which means we soon collected a tolerable handful of warp threads which had been missed altogether by the machine. Mr. D. observed that this evil might be easily remedied by using heavier leads to the harness below; which we remarked would only be substituting one evil for another; and, finally, he got into a passion, and called us a *prejudiced foreigner* who was unwilling to render honour where honour was due, and particularly so to Frenchmen!

MM. Dohmme and Romagney entered into an arrangement with Sharp, Roberts & Co., of Manchester, we believe through their agent, M. Molinard, by which patents were secured in Great Britain, and these gentlemen constructed a considerable number of the machines; all of which were sold to manufacturers on guarantee. About this time we addressed a letter to Messrs. Sharp, Roberts & Co., through our friend, M. Alexandre Andelle (who had frequently transacted business with them since they started their establishment) offering them the construction of an improved Jacquard of ours. In answer to this letter they informed us, that they had in their possession at the time (1837) as good a Jacquard as ours or any other, either in Great Britain or elsewhere, namely, the said Dohmme and

Romagney's machine. About six months after this, Mr. Roberts informed Mr. Andelle, that all the Jacquards sold by him on guarantee had been returned, and that he had lost 360*l*. by the d—d Frenchman! About 5000 of the machines were constructed in Paris, by the original patentees, most of which were sold on guarantee and returned or thrown aside as worthless, nobody continuing to use them except a few poor persons who obtained them for a mere trifle, and could not afford to pay for good machines.

At the earnest solicitation of M. Dohmme, we applied one of his machines to a power-loom; but in a short time were obliged to discard it for the following reasons:—

Firstly, the friction of the legs 27 and 28, in the holes through which they pass in the top or rest board, soon wears these holes much larger than they should be; which will be evident on referring to the Fig. It is clear that when the lifter 34, is raised, all the strain of the shed, and of the lead weights connected to the harness below, must be borne by the leg 28, and mostly by the bent part of it or hip 30.

Secondly, the leads must be much heavier in this machine than in those where springs are used; because the pressure of the needles against the card entirely depends on the leads; and should these not be of an uniform weight, the needles will be, in the same proportion pressed against the card with different degrees of force; or should two warp threads stick together in the shed, neither of the lifting wires to which they belong will act at all.

Thirdly, in order to bear the strain of the shed and weight of lead attached to each lifting hook, (which weight depends on the number of repeats in the breadth of the web,) the lifters or legs 28, must be made of strong wire, say No. 10, and this, of course increases the diameter of the eye of the needle 25; so that the needles occupy more room than with single hooks arranged in the old way (as in Fig. 96,) where it is customary to make both needles and lifting hooks of No. 14 wire.

In concluding this subject, we cannot but regret that so much money should have been wasted to no purpose, and such praise foolishly lavished on men who really deserved no praise at all, and this too by a committee of the celebrated "Société d' Encouragement pour l' Industrie Nationale." There is in our opinion no surer way of bringing such laudable institutions into utter disgrace in the eyes of the practical manufacturer, not only in France but elsewhere, than circumstances of this nature. Nobody will deny, that had either Messrs. Dohmme and Romagney, the committee of the

Société, or Mr. Roberts, been acquainted *practically* with the construction of machines for weaving figured goods in general, these ridiculous blunders might have been avoided, and the sum of 80,000 francs saved.

A patent was obtained in England, 23d May, 1842, by Frederick Goos, machine maker, Manchester, for improvements in the Jacquard; and, according to the patentee, the features of novelty consist, in the first place, in introducing a "*press-board,*" pierced with holes, and removing the cylinder from its usual situation; by this contrivance, he informs us, the cards are presented to the needles with *more certainty*, and any accidental breakage prevented, should the cylinder not be turned entirely round as the card advances; the cylinder is made plain, or not pierced, and employed merely for the purpose of advancing the cards, the press-board carrying them forward to act upon the needles. Upon the needle-board as well as on the cylinder, pegs or knobs are placed, in order to ensure the more certain presentation of the cards to the needles; the position of the pressers is also *reversed* upon the cylinder head, and the rods and springs are employed to act upon it from *below;* the bottom of the presser is beveled, which further (the patentee says) secures the correct position of the cylinder; an independent cylinder-head is employed outside the framing, with a flange to guide the catches; these catches being in *one* piece instead of *two.* Another peculiarity in this part of the apparatus, is made by having the cylinder-frame so constructed that the cylinder and press-board, with their carriage, may be readily removed, to permit the changing of the set of cards. The bottom rail of the cylinder frame is made adjustable by bolts and slots, that the guide may be always kept true; and the carriage and slide of the cylinder are kept firm by a cross-rod. By this arrangement, the slide may be placed *inside* the guide-rails, instead of *outside*, as heretofore. *Additional pressers* are placed at the top of the cards, to press them on the cylinder, their guide-rods sliding in holes in the cross-rails of the cylinder-frame; which arrangement is highly valuable, as it will prevent the cards from being damaged. Two rods with springs attached, having flat heads or discs counter-sunk in the needle-board, are used for the purpose of jerking *the card off the needles.* Another peculiarity in this machine (says Mr. G.) consists in having the lower bend of the lifting hooks extending above the top row of needles, and placing horizontal wires, one for each row, between the two plies or legs of the needles; this, Mr. Goos informs us, en-

ables him to dispense with the use of the ordinary springs, to press the needle forward, as used heretofore in *all* Jacquards.

The placing of the cylinder above the needles, as described, with the press-board below it, to carry the card forward against their points, is, in our opinion, one of the most ridiculous contrivances ever brought forth by way of improvement on the Jacquard. The constructing of the lifting hooks or wires with two legs, so that the bent or turned-up shank shall extend above the top row of needles, is quite old; indeed, it is even in common use among damask manufacturers in the town of Lurgan, Ireland; and we believe, if our memory serves us right, that Peter O'Flanagan, Esq. and Mr. Henry Kelly, of that place constructed some with as many as *three* legs, each of which was much longer than *goose's* legs. The additional card pressers, to keep the cards against the cylinder and prevent their being jerked off the knobs while the loom is in operation, is the only thing of value mentioned by Mr. Goos; but, unfortunately for him, this improvement is included in Poole's patent of May 12th, 1839, and represented in this work at Fig. 222.

The following Figs. represent an improved loom of our invention, for weaving damask table-cloths, piano-forte covers, furniture and window-curtain stuffs, &c., &c., &c., whether of silk, cotton, wool, hemp, flax, or other fibre, or parts of any of these combined; as, for instance, cotton and linen, wool and silk, wool and cotton, &c. Our American patent for this loom is dated April 15th, 1843.

Fig. 230, is a front elevation of the loom.

Fig. 231, left hand side elevation.

Fig. 232, right hand side elevation.

Fig. 233, plan of some parts of the loom.

Fig. 234, vertical section of parts enlarged.

Fig. 235, plan of double shifting cams.

Fig. 236, two views of button of double shifting cams.

Fig. 237, perspective of double shifting cams.

Fig. 238, perspective of the improved stop thread motion, for throwing the loom out of action when the weft thread, or threads, break or become exhausted in the shuttle, or shuttles.

Figs. 239 and 240, motion for taking up the cloth.

The frame of the loom is constructed nearly like those of our other looms, already described.

The Jacquard A, is placed upon the top of the frame of the loom. On the cylinder journal of the Jacquard there is a grooved pulley *b*, (Figs. 230 and 232) over which an endless cord or

band *c*, passes down to a similar pulley *d*, below it; this pulley is suspended on the end of a horizontal lever *e*, which has its fulcrum attached to the frame of the loom, as shown in Fig. 230, or the pulley may be attached to the slide, which moves up and down in guides, fastened to the frame, or may be otherwise fixed to obtain substantially the same effect without departing from the principal feature of the improvement. The cord or band *c*, is for turning the cylinder to the right or to the left (as the nature of the case may require,) when the wrong card is presented to the needles, without the weaver being necessitated to climb up to the machine for that purpose; the lever *e*, being free on its axis-pin *h*, (Fig. 230) will allow of its other extremity rising and falling according to the vibratory motion of the cylinder-carriage or frame *i*, and thus the cord or band *c*, will be kept of uniform tension during the operation of the loom; this cord or band revolves continually with the cylinder while the loom is in action.

It will now be seen, that by taking hold of the cord or band *c*, at the point *j*, (Fig. 230) and pulling down thereon, a new card will be brought to the face of the needles. When the cylinder is being turned to the right, the catch *k*, (Fig. 230) is to be lifted up, by means of the usual contrivance for that purpose, a view of which will be had in the Fig. The catch-cord may be so arranged as to lift up with the cord or band *c*, each time the misplaced card is recovered, by simply letting the bob cord *l*, (Fig. 230) hang down parallel with that part of the cord or band *c*, and then hold it with the cord or band *c*, when a card is to be recovered. This improvement is very useful where only one thread of weft is given to each change of pattern, because the loom will always run one card over after the weft thread breaks or becomes exhausted, before the shipper can fairly get the belt from off the tight pulley, on to the loose one; but in no case will the machine pass more than one card, without stopping, after the thread of weft breaks or becomes exhausted in the shuttle.

The second improvement consists in the mode of working the Jacquard machinery, and governing the shuttle motion, in order to obtain eight picks of weft to the card or change of pattern, and lose one pick, so as to procure sufficient time to change the pattern and thereby enable us to obtain a more smooth and uniform action for all the figuring parts of the machinery, and consequently making a more perfect piece of goods than where any sudden jerking of the warp yarn was caused; by this arrangement we are enabled

to obtain on the power-loom a mode of action *similar* to that obtained by the hand loom weaver.

The mode of operation on the hand damask loom is this:—The workman first depresses the pattern treadle, and thereby forms the shed of one change of the pattern, which treadle he keeps down until he has, with his right foot, worked over the eight ground leaves of headles, by means of the eight treadles, throwing in one pick of weft to each; he then lifts his foot from off the cylinder treadle, whereupon a new card is brought into contact with the needles of the Jacquard; he again depresses the same treadle, thus lifting the second change of pattern so transferred to the figuring machinery, and throws in eight picks as before, working over the ground treadles in the same manner, &c. Thus it will be seen, that there are two motions of the cylinder or pattern treadle to each card; and a more sudden action on this treadle in the power-loom than in the hand loom, where ground headles are used, would prove very injurious to the quality of the goods produced; besides, the liability of the warp threads to break would be greatly increased, as well as many other evils, well understood by every *competent manufacturer of figured goods.* Having thus described the nature of the operation on a hand damask loom, we proceed to explain the manner by which the same is obtained in the power loom, that is to say:

The inflexible connecting rod *m*, (Figs. 230, 231, 234 and 237) of the Jacquard, descends below the crank shaft *n*, and its lower end is connected with a horizontal lever *o*, (Figs. 231, 233, 234, 235 and 237) that extends back and is joined to the back part of the frame of the loom, working on the axis *p*; there is a stud projecting from this lever, behind the point of its junction with the vertical lever, on which is a friction roller *q*, (Figs. 233, 234 and 235) that plays in a groove in the face of a wheel *r*, more particularly described hereafter; the driving or crank shaft is furnished with a fast and loose pulley *s s*, (Figs. 230, 231 and 233) in the usual way; the cranks by which the lay is worked are inside the frame of the loom (see Figs. 231, 232 and 233,) and on the end opposite the pulleys there are two pinions affixed; the inner one *t*, (Fig. 232) is half the diameter of the spur wheel *u*, on the second or cam shaft v; the outer pinion is *one ninth* the diameter of the wheel w, (Fig. 232) into which it works; this wheel being on the third shaft x, which is placed forward of the cam shaft v, (as shown in the Figs.) and on a level with it; the third shaft (which works the Jacquard) does not extend from side to side of the loom, but

terminates a little beyond a brace a^2, which extends from front to back of the loom frame near the centre, and supports one of the journals of the Jacquard shaft. On the cam shaft v, are two double grooved cams b^2, which receive motion as hereinafter described; the two arms of each of the cams b^2, project radially, from opposite sides of the shaft, and are so placed with reference to each other, that when one is in action on the treadle c^2, the other revolves without striking it; the hub which joins the two arms is connected with the shaft by a feather upon the shaft v, so that the cam can slide sideways and put either of the arms in contact with the treadle c^2. There are two of these treadles which are attached to the common picker stick d^2, (see Figs. 230 and 231) in the usual way; these treadles are depressed alternately by the double shifting cams b^2, for eight picks of the shuttle or weft; the cams are then made to slide sideways and miss *one* pick; the other arms are then brought into contact with the treadles, and eight picks more are thrown; at every *ninth* beat of the lay, the shuttle *remains in the box*, for a purpose hereinafter described. On the Jacquard shaft which revolves once for every nine beats of the lay, there are two wheels or drums e^2, affixed opposite to the double shifting cams b^2, which wheels have two parallel grooves in their periphery, near each edge, around *eight ninths* of their circumference, from which point are oblique grooves crossing over to the other side, and forming a × at their point of junction; these grooves guide the ends of the two levers f^2, which project backwards over the double shifting cams b^2, to the back of the loom frame, where they have their axes on stud-pins g^2, the forward end of each of these levers f^2, which is in the groove, has a follower or oval button h^2, on it (see Fig. 236, where this button is shown of the full working size) which is made to turn and follow the grooves as required; around the hubs of each of the double shifting cams b^2, under the lever f^2, a groove is turned into which a pointed set-screw from the levers f^2, projects (one from each lever;) one of the wheels e^2, is placed with the oblique groove *one ninth* of the circumference of the wheel behind the other, so that first one of the cams b^2, will be shifted and then the other. The change takes place just before the acting arm would strike the treadle, which brings the other arm on the same cam in contact with the treadle at the next semi-revolution, and prevents the loom from losing more than one pick to the change of pattern of the Jacquard.

The Jacquard shaft x, also carries a wheel r, on its end, in

the face of which a concentric groove j^2, (see Fig. 237) is cut eight-ninths of its circumference; the other ninth the groove curves outward, so as to form a cam which will act on the connecting rod *m*, of the Jacquard, as above described; and while the shuttle misses one pick, (by remaining at rest in the lay box,) the pattern has time to change, even although the loom be in the most rapid operation.

Suppose, for example, that a change of pattern is lifted by means of the wheel *r*, which is keyed on the third shaft x, as above described, then we begin to throw the shuttle from the right hand side of the lay to the left, which will be accomplished by the off-side shuttle treadle, marked 1, (see Fig. 237;) the next pick will be treadle 2; the third pick 1; the fourth pick 2; the fifth pick 1; the sixth pick 2; the seventh pick 1; and the eighth pick will be treadle 2. The shuttle now being at the right hand side of the lay, as before, must not be thrown until the cylinder brings a new card into contact with the pattern needles, and thereby transferring a new change of pattern to the warp yarn; this requiring an extra motion of the driving shaft to effect, could not be accomplished to advantage while the eighth or last pick of the change of pattern was being given, as above, and as no pattern warp would be raised in time for the semi-revolution of the crank-shaft, and there not being sufficient time to lift the pattern shed, before the crank arrived at its proper point to give the shuttle impulse; if the shuttle treadle 1, was acted upon, it would cause the shuttle to be thrown over the entire body of the warp yarn. Now, to avoid this, as soon as the eighth pick was thrown to the right by treadle 2, then the cam which works the treadle 1, is shot out sideways to the right by means of the cross groove × in the double grooved wheel e^2, bringing the next striking arm of the cam inside (towards the right hand) of its treadle, thereby moving the lever f^2, (see Fig. 237) with its follower or oval button h^2, (Fig. 236) from the groove q^2, to that of p^2, thus throwing off the arm of treadle 1, and bringing in its place the other arm of the same cam, preventing the shuttle from being thrown the ninth motion, the treadle 1, not being then acted upon.

Secondly, it is now evident that treadle 2, must not be acted upon the tenth motion, because that treadle throws the shuttle to the right hand side, where it already is. The next thing to be accomplished, is to slide the other cam, which works treadle 2, sideways, so as to throw the acting arm to the right hand side of treadle 2; which is effected by means of the lever f^2, and its follower or oval

button h^2, being carried from the groove k^2, (see Fig. 237) to that of the groove 1^2, in the same order as the first.

Thirdly, the two acting arms of the double shifting cams b^2, will now give in eight regular picks of weft to the change of pattern, the first pick throwing the shuttle from right to left, and so on, until eight are given; whereupon, the action of the apparatus will be reversed, and will continue to work right and left every other eight threads of weft, missing one pick, or beat of the lay, only, to each change of pattern.

The third part of the invention is for working the front mounting, which consists of eight leaves of headles, marked t^2, (Figs. 230, 231 and 232,) forming a satin or tweeled ground; these leaves are connected above with double lifting coupers u^2, (Fig. 230) the outer ends of which are connected by a shackle. The shackles on the coupers above named, are connected with a set of lifting marches y^2, (Fig. 233) near the bottom of the frame, by rods or wires z^2, (Figs. 230 and 232); these marches are parallel with the Jacquard shaft x, and have their fulcrums near the centre at a^3, (Fig. 233;) between these marches there is another set b^3, called sinking marches, the fulcrums of which are at the side of the frame; the opposite ends being connected to the headles underneath; nearly over the centre of the raising and sinking marches, a cylinder or drum c^3, (Fig. 230) is placed, the journals of which are on a level with, and at right angels to, the Jacquard shaft x, they are geared together by bevel wheels e^3, (Figs. 230 and 233) and make the same number of revolutions. The cylinder c^3, has *eight* grooves or divisions turned in its periphery, each of which is wide enough to extend over two of the marches, (a raising and a sinking one;) the projections or rollers f^3,(shown clearly in Fig. 230) in the cylinder occupy the space between the second and third, fourth and fifth, &c., throughout the series. In the cylinder are inserted eight iron spindles, near its periphery and parallel with its axis; these spindles pass through each of the sinking and raising rollers f^3, between the grooves or divisions, and serve for their axes, which are just half the thickness of the grooves or divisions above named, and have a hub projecting from one side to fill their respective grooves or divisions and keep them in place; two pulleys thus constructed are placed beside each other in the two first grooves or divisions, and a steel spindle is passed through them, their hubs being towards each other; consequently, when the cylinder c^3, is turned so that these rollers come in contact with the projections on the marches directly under the cylinder, one depresses the first raising march in the series, the

other the first sinking march. If the hubs of the rollers f^3, were placed the other way (reversed), the first sinking march and the second raising one would be acted on, these being placed under the first roller, and so on. The others are placed in proper order for an eight leaf satin tweel, and need no further illustration. The rollers f^3, can be turned on either side, so as to sink or raise the headles, as required; and by drawing out the spindles, the rollers can be so arranged in the cylinder as to form different kinds of tweels, &c.

From the foregoing description it will be evident, that variations may be made; as, for instance, the giving off a less or greater number than eight picks of the weft per change of pattern; and although, in the foregoing description and drawings eight picks of weft per card, only, are mentioned, the machinery is not confined to that number; the Jacquard shaft may turn once to five beats of the lay, or once to seven, &c.; which will give four or six picks of weft to the card or change of pattern, and four or six leaves of ground headles will be used instead of eight, as in the present instance; all of which any experienced manufacturer or power loom maker will at once perceive.

For very wide textures, two of the cylinders c^3, may be used instead of one set, and also two sets of the coupers u^2, the lifting marches y^2, and the sinking ones b^3, one complete set at each side of the loom. The reason of this is obvious, because the headles being very wide, say three yards or more, the strain on one set alone would be very great. We therefore prefer the use of two sets instead of one, on very wide fabrics, and particularly so for the manufacture of linen table cloths, both sets being geared to correspond and to act at the same time on their respective marches, &c. But on the narrower fabrics, say under forty inches wide, one set alone, as herein above specified, will be quite sufficient.

The fourth part of the improvements consists, in a new mode of regulating the warp beam. The warp beam g^3, (Figs. 231, 232 and 233) is surrounded at its ends by friction straps h^3, each of which descends to a horizontal lever i^3; the fulcrum of this lever is supported outside the frame by a projecting iron j^3; on the other end of this lever, the friction weight k^3, is suspended, one weight to each side of the loom, (as in Fig. 233,) to which a connecting rod l^3, is attached, that connects it with an upright lever m^3, (Fig. 231 and 232;) this lever is made with a slot in its lower end to regulate the distance from the fulcrum o^3, of the lever, at which the connecting rod l^3, is attached; the fulcrum is about one third its length from the

top. The upper ends of the levers m^8, support the journals of a small roller p^3, which bear against the warp beam g^3. When the weaving commences, and the beam is full, the roller p^3, is very far from its centre, and the weight k^3, is near the end of the lever i^3; as the size of the warp beam decreases, the roller p^3, approaches nearer to the centre of it, and the weight k^3, is moved towards the friction strap h^3, thus gradually decreasing the friction on the warp beam and regulating the tension of the warp; the weights k^3, will be drawn backwards as fast as the warp beam decreases in size; the friction weights may be drawn back by springs, or by some other suitable contrivance, as, for instance, by weights and cords passing over pulleys, &c. as in Figs. 231, 232 and 233; any required degree of tension may be given to the warp yarn, by simply adding cast-iron quoits on the perpendicular spindles, which are screwed into the weights k^3, for the purpose, as shown in the Figs.

The fifth part of the improvements consists, in a method of stopping the loom directly when the thread of weft breaks or becomes expended in the shuttle. This contrivance is applicable to what is called the stop thread motion; for which motion patents were granted several years since to Charles Cunningham, Esq., of Paris; and in England, to Messrs. Wells and Eccles, of Manchester, for another modification thereof, bearing date 5th Jan. 1838; and for another modification still, to Moses Poole, Esq., of the Patent Office, bearing date 12th May, 1839. Now, in order that the nature of this invention or improvement may be more clearly understood, it is necessary for us to describe so much of the methods employed heretofore, and just referred to, as will enable the reader to see the peculiar advantages of the present modification. Several of the parts of this mechanism are the same as in Poole and Cunningham's patents. In the patent granted to Wells and Eccles (which is described in vol. 13, new series, of London Journal of Arts and Sciences) there are two double acting levers, marked T, and U, being connected together with a small string or wire; these levers vibrate on two stud pins, which serve as their axes, and are riveted or bolted to a plate, secured or made fast to the side of the loom, directly over the threads or cords P, q; the top set of which cords is connected to that end of one of the double acting levers, marked T, which projects over them; to the opposite end of the other double acting lever, there is made fast a small knob W, which plays up and down between a piece of iron on the belt shipper, and the front of the lay: all of which will be seen in the account of Wells and Eccles' patent just alluded to. It will at once be perceived, that in this modification, the double act-

ing levers T, and U, will be kept on the continual wibble-wabble (shaking-quaker fashion) when the loom is in operation, and thus the knob W, will sometimes pop itself between the shipper and the lay when the weft is not broken, or expended on the bobbin. And, if only one of the double levers T, and W, is used, and is at all connected with either the top or the bottom set of threads P, q, by means of the other small connecting threads, as in the foregoing, then, the motion will be quite as uncertain. Now, to remedy this evil, Poole's patent, of 12th May, 1839, has, instead of the double acting levers, above referred to, a small jogged piece of iron, resting on the girth of the loom and connected to the side of the shipper slide (see Fig. 225); to this jogged piece of iron is attached a set of small cords, which are connected to the under tier of the stop motion strings; by this improvement the double acting levers T, and U, (in Wells and Eccles' patent,) are done away with altogether. Poole's method is thus rendered far more certain than the other, because the jogged piece of iron, resting on the side of the loom, renders the motion more steady.

There is a series of cords q^3, (see Figs. 231, 232 and 238) attached to the weights r^3, (Fig. 231) and passing over the pulleys s^3, through the headles or endless band t^3, (Figs. 230 and 231) under the cumber-board, the headles being worked by the cam shaft—all as described in the patent granted to Moses Poole. The cords q^3, after passing over the shuttle-race, instead of being all tied to one iron on the breast-beam or front board, are, as shown, half of them, or those passing through the mails in the back headle, affixed to an iron u^3, that projects up in front of the breast-beam or front guard board; this iron extends down to the bottom edge of the breast-beam or front board, to which it is attached, and then turns at right angles under it, as at v^3,(Figs. 231 and 238,) the end terminating in a vertical pin or turned-up part y^3,(see Fig. 238) a little shorter than the part u^3; to the top of this turned-up part y^3, which has a number of holes for the purpose, the ends of the cords or cat-guts are attached. On the breast-beam, there is a strong piece of sheet-iron w^3, screwed or otherwise made fast, that extends inward to the iron just described, and is attached to the breast-beam. On that end of the iron u^3, next to the lay, a stud-pin projects, forming a fulcrum for a lever z^3,(see Fig. 238;) this lever curves up from one side of the fulcrum slightly, and thence projects under the upper set of cords q^3, which cords are attached to the front end of the iron u^3; on the other side of the fulcrum the lever z^3, extends out beyond the framing and curves down, its end bearing a knob (Figs. 231 and 238). The

belt shipper a^4, and its catch b^4, (Fig. 238) are of the usual construction. On the handle of the shipper is a projecting piece c^4, that reaches beyond the upright of the frame. In Fig. 238, the shipper a^4, is represented off, and consequently the loom stopped. The shuttle at each pick passes between the upper and under cords q^3, and when it enters the box it leaves the weft thread, if not broken or exhausted, across the under set; the lower set of cords are then raised, and the upper ones depressed till they meet in the centre of the shed, and are prevented from going farther by the thread of the weft; but if there is no thread left across between the sets of cords q^3, they pass each other and the upper ones are brought down low enough to depress the end of the bent lever z^3, which is under them; this elevates the knob x^3, on the other end, and brings it between the lay and the projection c^4, on the shipper, and throws it off, and consequently causes the loom to stop.

Fig. 239, shows as much of a power loom as will enable us to explain an improved method of taking-up the cloth; and Fig. 240 represents the apparatus detached from the loom. d^4, is the driving wheel, on the end of the crank shaft, taking into the wheel e^4, on the cam shaft; on this shaft we place an eccentric f^4, surrounded by a collar g^4, made in two parts and held together by bolts h^4; to one side of the collar is connected a rod i^4, having a screw joint j^4, for receiving the end of a rod k^4, which works on the axis pin l^4; this pin may be raised or lowered in the slot m^4, of the vertical lever which has its fulcrum at n^4, to suit the number of picks of weft required per inch of the goods to be produced; the upper end of this lever has also a slot in it, carrying a stud-pin o^4, and this stud-pin forms the axis of the click or drag p^4, which draws round the cloth roller as usual. Now, suppose that the loom is put into action, the eccentric f^4, will cause the lever m^3, to oscillate, and thus a continuous rotary motion will be communicated to the cloth roller, through the medium of the click or drag p^4.

Having now described the nature of the improvements, and the manner in which the same may be performed, it is to be understood that we do not limit ourself to the particular arrangement of machinery required for a loom to weave figured fabrics, as we are quite aware that different forms and arrangements will be found necessary for effecting the same objects in looms for weaving other fabrics, and to which some of these our improvements may be applied, but they will be such as any experienced workman may at once understand from the description here given, and will be governed by the nature of the loom or looms to which they are to be applied, as well as the

goods to be produced; as, for instance, the improved method of stopping the loom when the weft thread breaks, may be applied with advantage to any power loom. Nor do we mean to limit the said improvements to looms with Jacquard machinery, as they are also applicable to various other kinds of figured looms; for instance, cylinder or barrel looms, (like that described at page 182,) where a cylinder is used instead of Jacquard machinery.

Firstly, what we more particularly claim as the inventions or improvements, is the combination of the third shaft x, with the crank shaft *n*, and cam shaft v, the Jacquard and cam shafts being driven by separate pinions on the crank shaft, in the manner and for the purpose above specified.

Secondly, we claim the combination of the double sliding cams b^2, one for each of the shuttle motion treadles c^2; which cams slide independently of each other from right to left, and from left to right, in order to give *eight* regular motions on the right and *miss one*, then change positions; and in connexion therewith, the two double grooved wheels or drums e^2, on the Jacquard shaft x, and the two regulating levers or rods f^2, by which the shifting or sliding motion is communicated to the double shifting cams b^2, constructed and arranged substantially in the manner and for the purpose herein set forth.

Thirdly, we claim the combination of the cylinder c^3, with the concentric cam wheel *r*, working the Jacquard, for acting on the marches of the headles, in the manner and for the purpose above described; but we do not claim the cylinder c^3, as new in itself, the same having been used for other purposes heretofore.

Fourthly, we claim the combination of the endless cord or band *c*, with the Jacquard cylinder, pulleys *b*, and *d*, and horizontal lever *e*, in the manner and for the purpose set forth.

Fifthly, we claim the apparatus for decreasing the tension on the friction strap, on the warp roller, as the warp unwinds; that is to say, the combination of the roller p^3, and connecting rods l^3, with the weights k^3, in the manner and for the purpose herein described.

Sixthly, we claim the improvement in the motion to stop the loom when the weft thread or threads break or become exhausted in the shuttle, as above specified, viz: the combination of the iron u^2, on the breast-beam or front-board of the loom, the turned-up end y^2, and lever z^3, constructed and arranged as herein made known.

The improved method of taking up the cloth represented in Figs. 239 and 240, was invented by us in the year 1831, and which we first applied to a muslin loom at the establishment of Messrs. Claude Girdwin & Co. Glasgow, Scotland.

Fig 230.

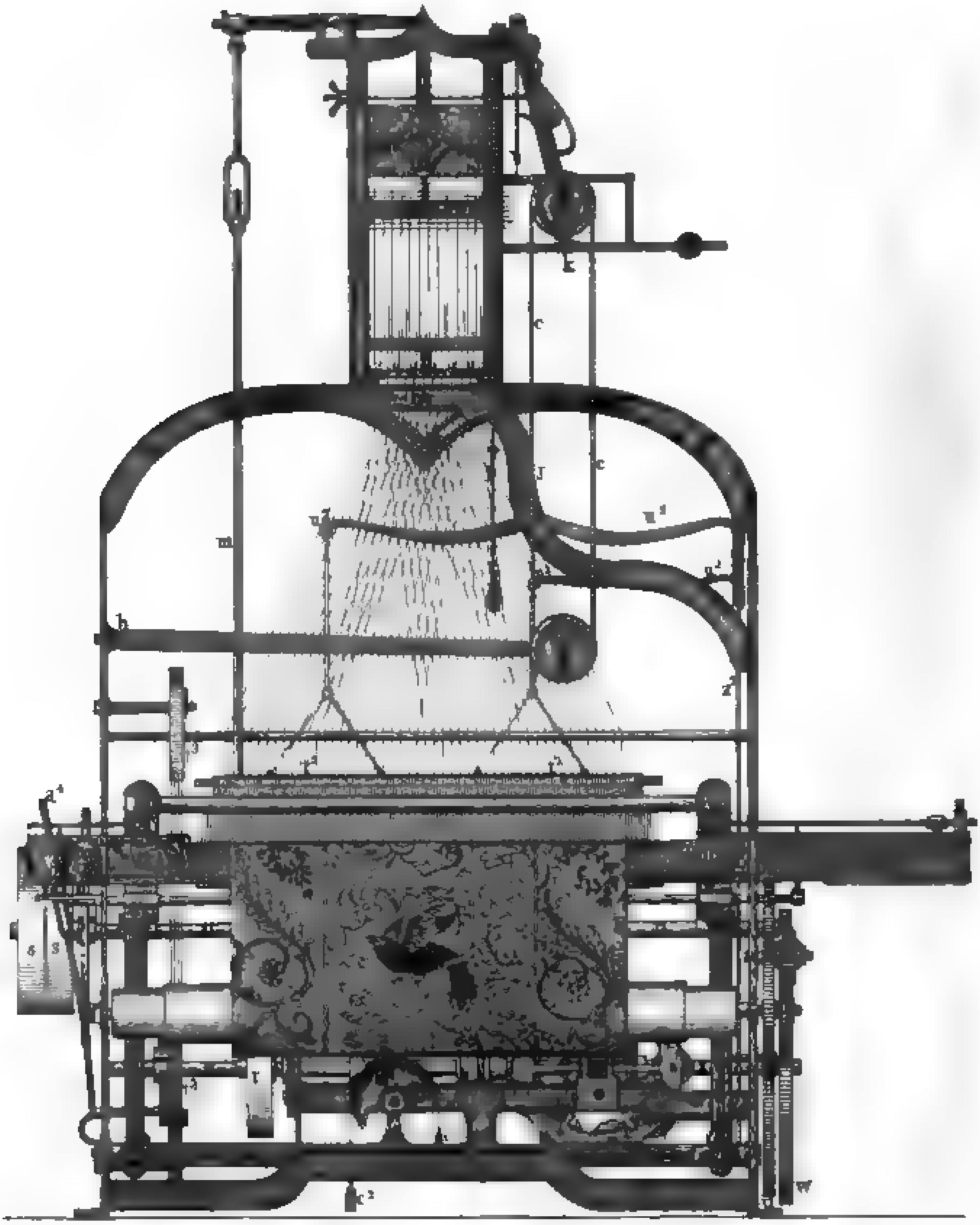


Fig. 231.

Fig 232.

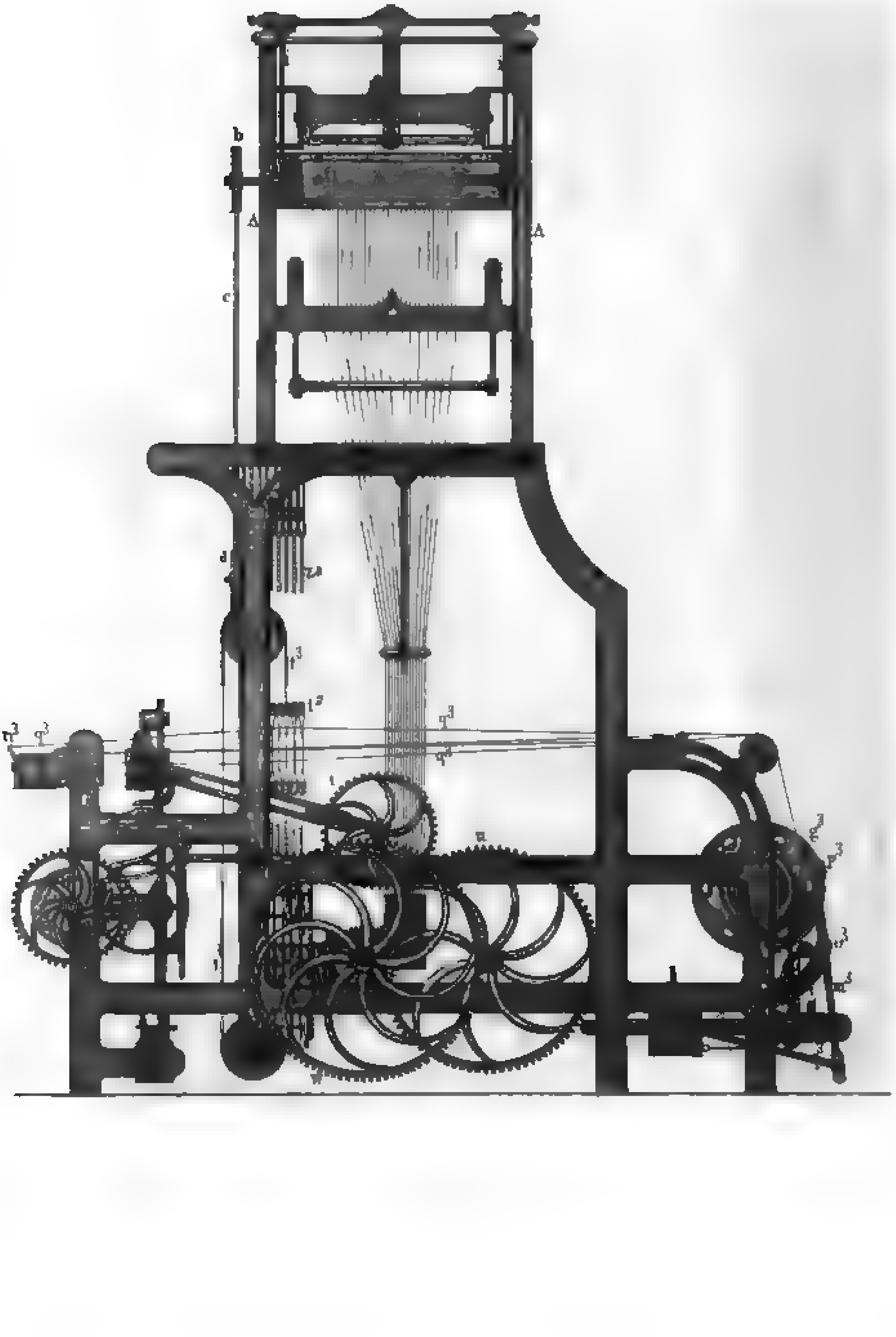


Fig. 233.

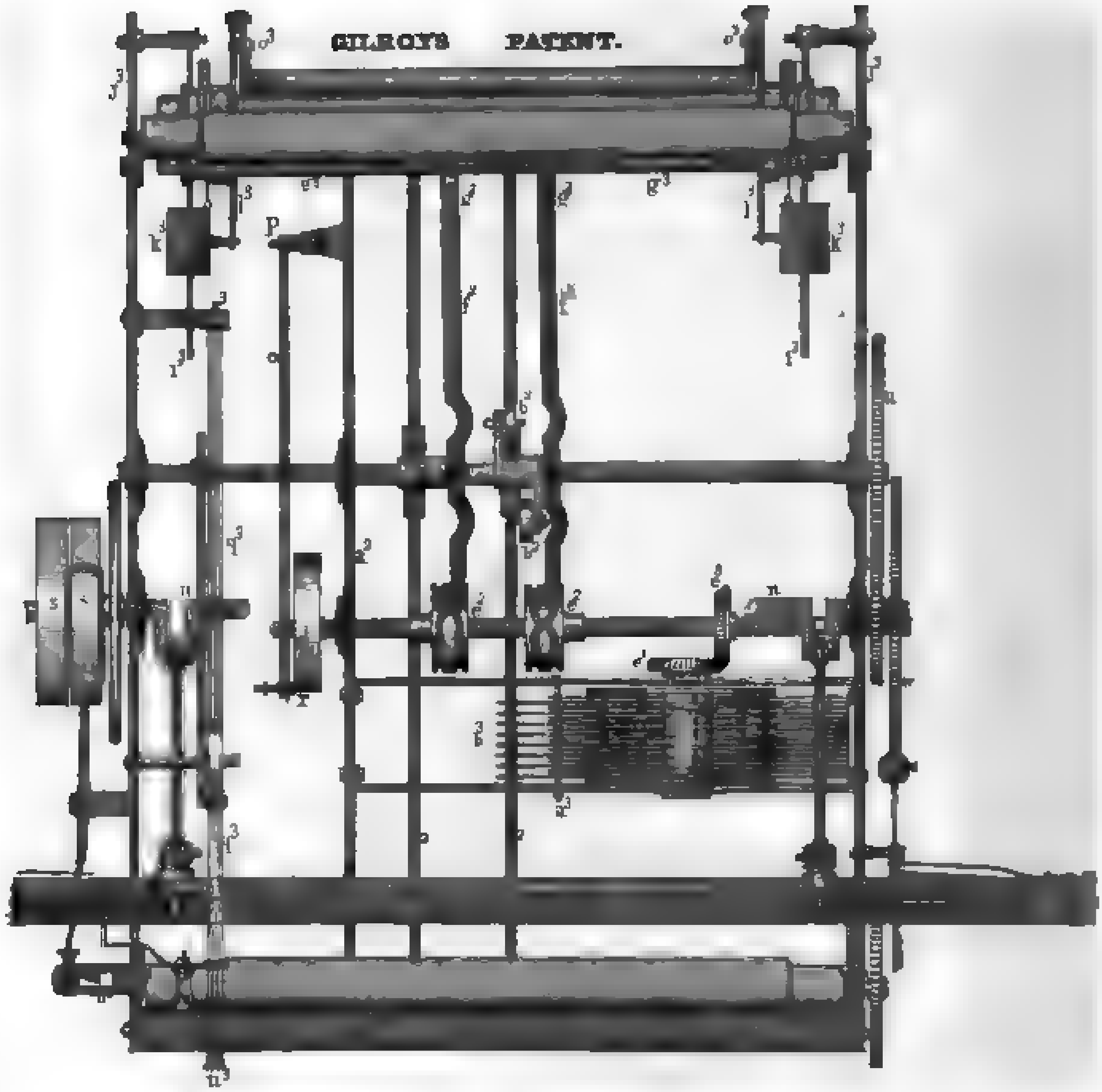


Fig. 234

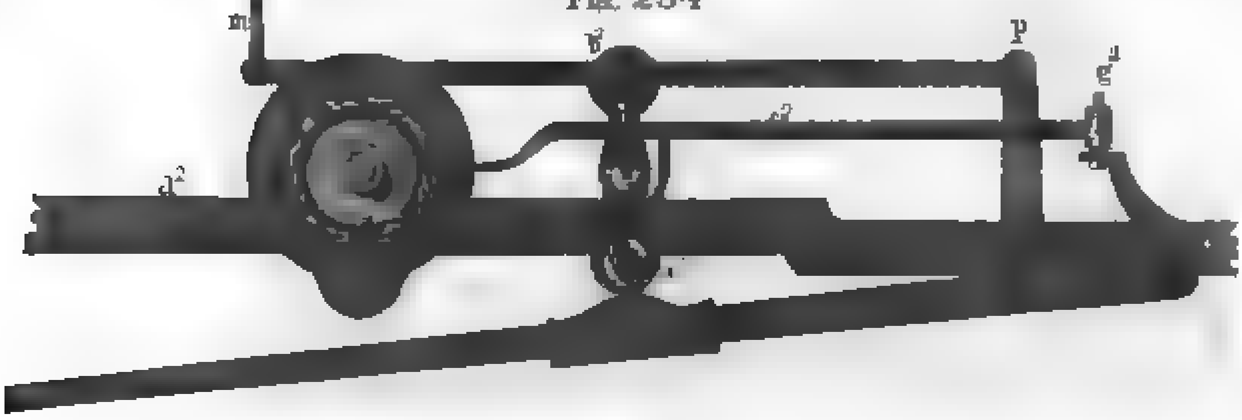


Fig. 235.

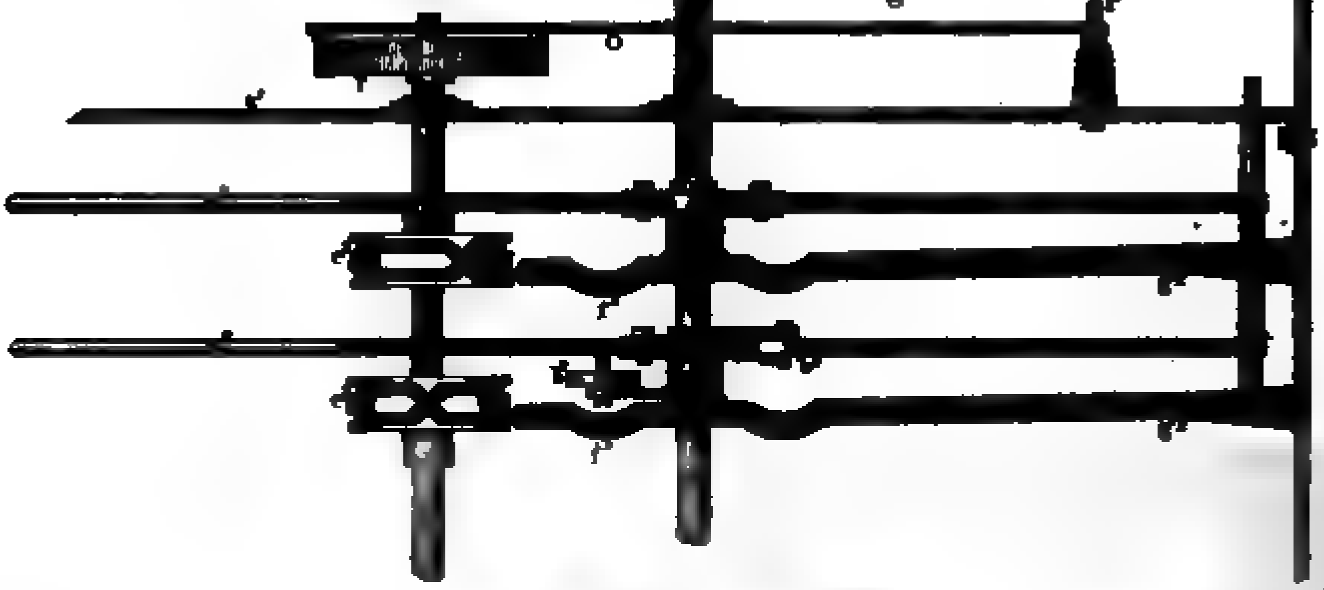


Fig. 237.

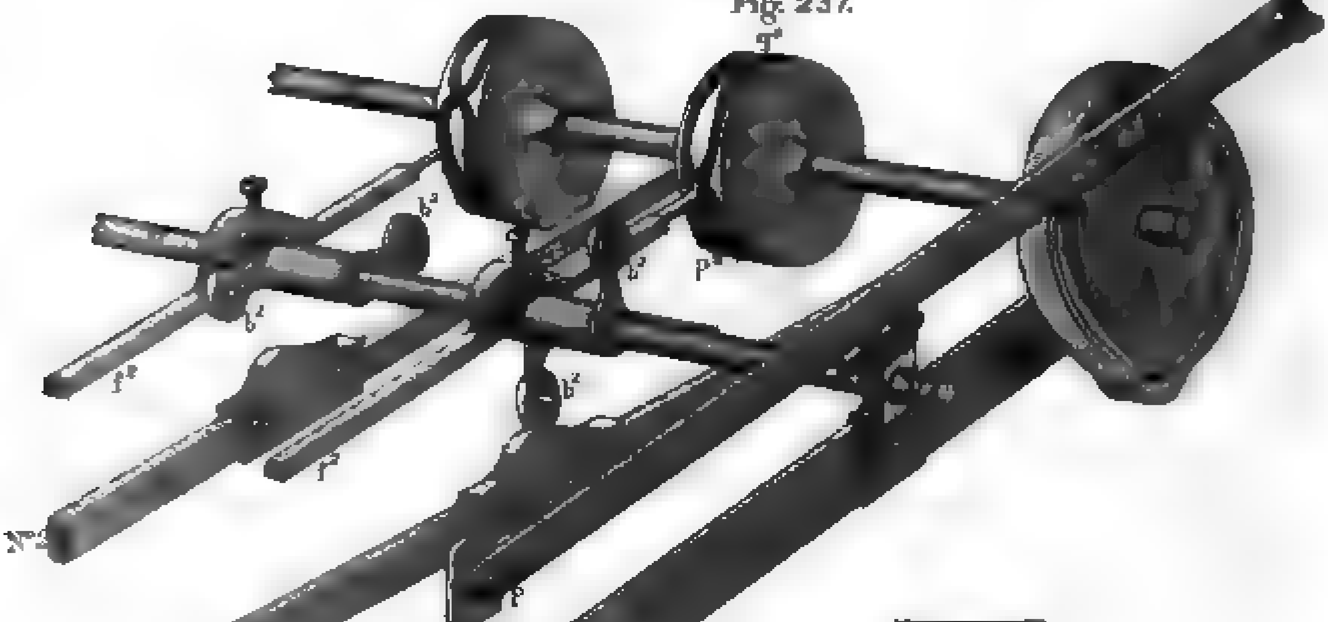
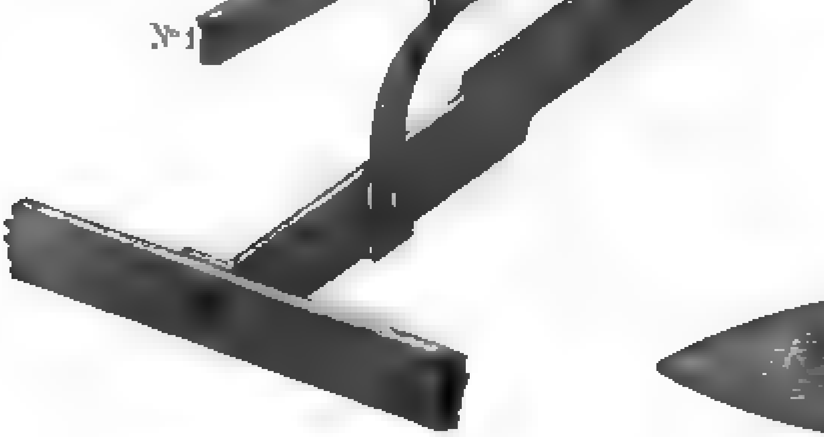



Fig. 236.

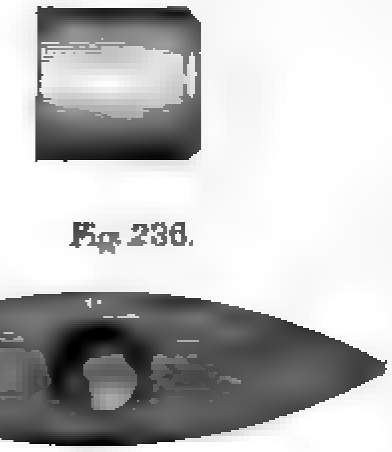


Fig. 239.

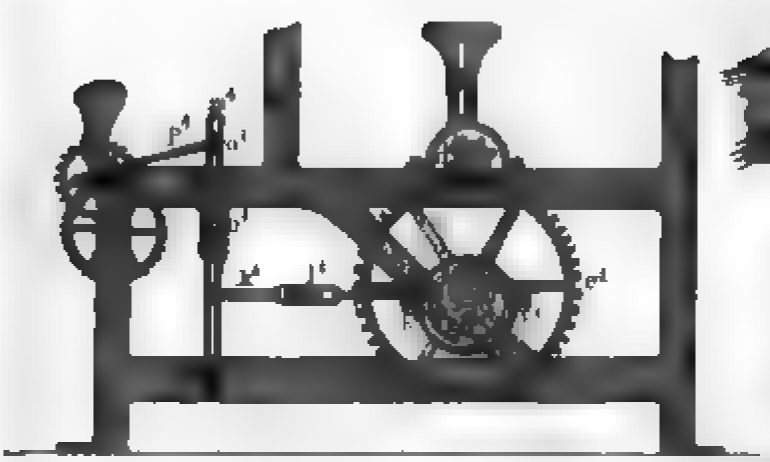


Fig. 238.

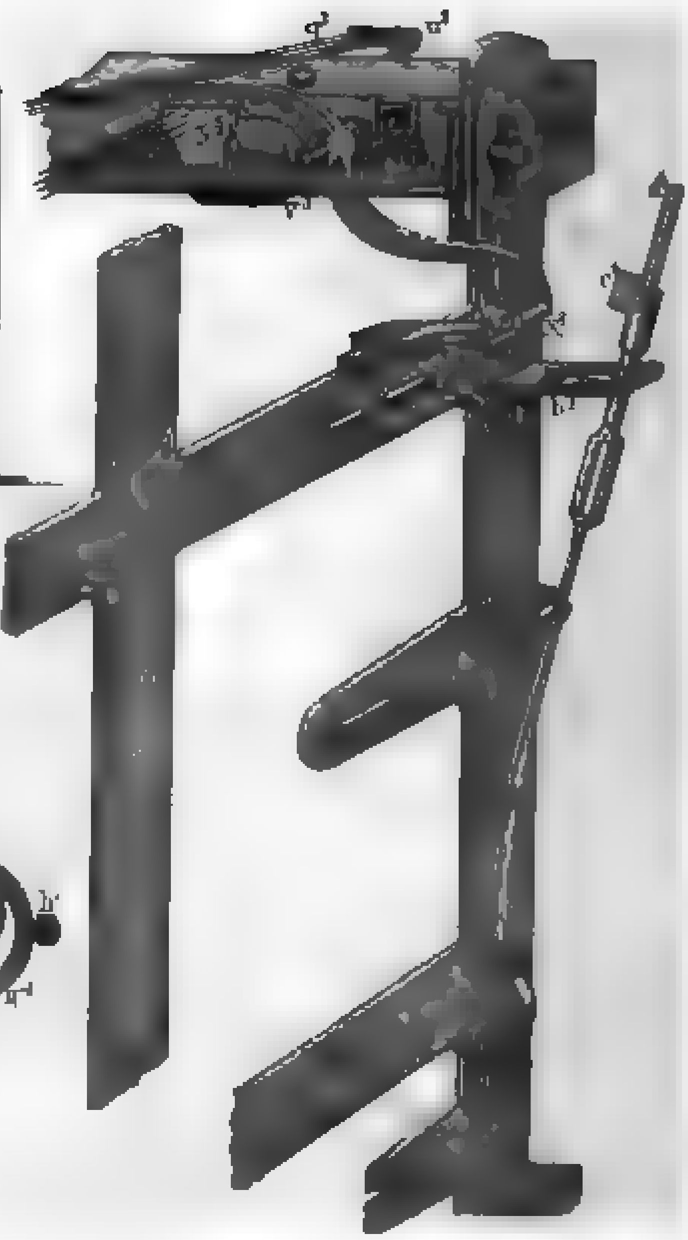
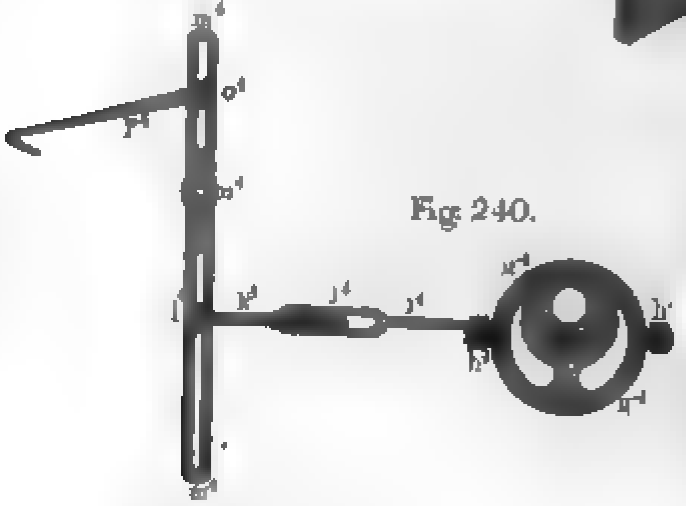


Fig. 240.



The foregoing improvements do not constitute over one-third of our inventions in looms. We have obtained patents in the names of Poole, Cunningham, Truffaut, and others, for 25 or 30 other improvements, in the manufacture of plain, tweeled and figured goods by hand and by power, which we cannot describe in this work; indeed, these improvements are mostly applicable to power looms for weaving carpets, coach-lace, &c. &c. &c; but we intend laying them before the public, along with other interesting matter, at no very distant period.

On application to the Hon. H. L. Ellsworth, Commissioner of Patents at Washington, D. C., he furnished us with the following statement of claims of the patents granted to Erastus B. Bigelow, Esq., of Lowell, Mass. Patent, dated May 16, 1842:—

"*First*, I claim the placing and working of the journals t', u', v', and w', as shown in figures 1, and 3, of the accompanying drawings, above the Jacquard machine, for the purpose of keeping the *knot cords straight*, and thereby securing their proper action *on the trap boards* g', *and* h', when said trap boards are raised; and also the *raising of one* of said *trap boards whilst the other descends* in order to equalize the *powers* required to drive the loom; and in *combination* with this arrangement, I likewise claim the working of the *card prism or polygon*, by means of a cam, or other *analogous* device operating on, and working said card prism or polygon, *when the trap boards are at rest;* the respective operations herein referred to, being carried on or effected, substantially in the manner herein fully made known.

"*Secondly*, I claim the *combination formed by the two rollers* d^4, *and* e^4, *as shown in the drawings, through which rollers the cloth passes, with the vibrating or tension roller* i^4, which is employed to give tension to the warp, substantially as described.

"*Thirdly*, I claim the *connecting*, the vibrating or tension roller i^4, with the machinery *employed to turn the warp beam, for the purpose of regulating the action of said machinery on said warp beam*, and thereby determining the quantity of warp delivered out, in the manner set forth.

"*Fourthly*, I claim the manner in which I *construct my shuttle boxes*, as described under the head of my third improvement, and represented in the respective figures therein referred to, together with the modifications thereof herein made known; the said shuttle box *consisting* of a *table*, with *springs* and *catches*, and having a *projecting pin on each end, which is to be received and operated upon by the reciprocating arms* as described.

"*Fifthly*, I have *represented* and *described* my shuttle boxes as *disconnected* with the *lathe* (lay, we suppose,) but I do not now claim the mere disconnecting of these parts, this having been the subject of a claim in the specification of a patent for a loom for weaving coach lace granted to me on the 20th day of April, 1837—But I do claim as an improvement thereon, the working of a series of shuttle boxes, so disconnected, and supported by the frame of the loom, or other stationary part of the structure adapted thereto in the manner set forth, that is to say, having the said shuttle boxes to *turn or slide in stationary fixtures attached to the frame of the loom*, or in any other manner which is substantially the same. A series of shuttle boxes so disconnected may be applied, and I intend to apply them to looms in which the fly shuttle is used, and I do not limit my claim, therefore, to their employment in looms of the kind herein described (the above claim is a 'cute one.)

"*Sixthly*, I claim the manner of arranging and combining the machinery employed to cause the above mentioned reciprocating arms, rods or bars, to receive, retain or discharge the shuttles, when they are *handed through the warp!*

"*Seventhly*, I claim the manner of constructing and arranging the apparatus herein described, for preventing the selvage of the cloth from being drawn in, and of stopping the loom when the *filling breaks*, or is exhausted on the bobbin.

"*Eighthly*, I claim the manner of throwing the loom out of gear, when a change of colour is required in the filling, by means of the *connection formed* for that purpose between the *Jacquard machine* and the *shipper*, whether such connection be made precisely in the manner described, or in any other which is substantially the same."

Patent, dated May 26, 1842; antedated, May 1, 1842.

"*First*, I claim the application of the *measuring roller i*, to the cloth or yarn, for the purpose of regulating the action of the machinery employed to deliver out the chain or warp, or to take up the finished cloth in the manner above described, or under such modifications thereof as shall produce the same end by similar means.

"*Secondly*, I claim the combination formed by the *tension roller b*, and the measuring roller *i*, co-operating together in the manner and for the purpose herein set forth.

"*Thirdly*, I claim the mode of giving an uniform tension to each thread of woof or filling as above described, that is to say, I claim the *grasping of the thread of woof or filling, at a point between the shuttle and selvage of the cloth*, by the bars e', e', and q', q', or by a pair of pliers operating in a similar manner as set forth, to-

gether with the mode of giving tension to the filling as above set forth, or in any other manner which is substantially the same.

"*Fourthly*, I claim the manner in which I have connected the shipper and the rotating shaft x', with the apparatus employed to give tension to the woof or filling, for the purpose of throwing the loom out of gear when the woof or filling breaks, or is exhausted on the bobbin."

Patent, granted May 30, 1842; antedated May 1, 1842.

"Having thus fully described the nature of my improvements, in the loom for weaving counterpanes, and other figured articles, and having, also, set forth several different modifications thereof, and particularly in the manner of forming and arranging the *cams* on the *cam shafts*, by which the required motion is given to the respective treadles, so as to correspond in their action with the arrangements made in the other parts of the loom, it is to be understood that I do *not* claim, nor do I intend to *limit* myself to the *particular* arrangement of the cams and treadles, these *not* constituting a distinguishing or an *essential* feature of my improvements; these consisting, mainly, in the mounting of the loom and of tying up the harness, so as to admit of the employment of *one* or *more moveable harness-boards*, and of *one* or *more leaves of headles*, and of the *Jacquard Machine* in the *power loom*. By this arrangement I am enabled to produce a free and open shed of the warp, and to allow one part, or shed, thereof to *descend whilst the other is rising*. What I claim, therefore, as constituting *my inventions*, and which I *desire* to *secure* by Letters Patent, is the within described manners or modes of mounting the loom, and tying up the harness, and of working the same, in which, under its *various* modifications, I *combine a moveable harness-board, or boards, with one, or more, leaves of headles, or harness, and with the Jacquard Machine in the power loom, such arrangement and combination being substantially the same with that herein described.*"

We have given above Mr. Bigelow's claims, exactly as received from the Commissioner of Patents; and we shall now offer a few remarks upon them, beginning with his patent of 16th May, 1842.

The first claim, regarding the action of the knot-cords and trap-boards, contains no new feature, as has been already stated. See pages 446 to 448. The working of the card prism or polygon, (Jacquard cylinder), by means of a cam, when the trap boards are at rest (or even in motion) has been done long since. Mr. J. Kyle, of Glasgow, M. Eug. Lefebre, of Lyons, and M. R. Dubois, of Paris, used cams and other contrivances for that purpose many years

ago, on looms for weaving some kinds of vestings and furniture stuffs; and we ourself effected the same thing as far back as the year 1831, on a loom for weaving quilted vesting stuffs, but owing to improvements which we afterwards made in the mode of tying up the harness, we were enabled to dispense with the cam altogether.

Both the second and third claims are comprised in Poole's, Cunningham's, Truffaut's, and Wilbur's patents. See page 462, and Figs. 218, 219 and 220.

The fourth claim contains nothing worthy of notice.

The fifth claim, for disconnecting the shuttle boxes from the lay, making the boxes to turn or slide on stationary fixtures attached to the frame of the loom, is ingenious, and, if simplified in its mechanism, might be found advantageous in the manufacture of many kinds of fancy goods; but, besides Mr. Fletcher (see page 394) there are five other different claimants to the honour of this invention. It remains to be seen, therefore, to whom this contrivance *justly* belongs; which our forthcoming treatise on carpeting will clearly set to rights.

The sixth claim merits no attention.

The seventh claim, for preventing the selvage of the cloth from being drawn in, and of stopping the loom when the weft thread breaks, is illustrated at pages 403, 416 to 421, 443, 454 to 463, and at 468 to 478.

The eighth claim is, for throwing the loom out of gear by means of a connection between the shipper and the Jacquard machine. If by this Mr. Bigelow means the connection of the shipper with a few spare Jacquard needles, one for each colour employed, these needles being acted upon by the card when a new colour is to commence in the cloth; we say, if he means this, he claims that which *truly belongs to us.* Besides, we have adapted Jacquard needles, (with lifting hooks, made of No. 10 wire,) for working a *series of shuttle boxes*, either in hand or power looms; and for which we obtained patents, in the name of Mr. Poole, and others, several years before the date of Mr. Bigelow's patent. A modification of our plan for working the shuttle boxes with the Jacquard, is specified in Poole's patent of May 12, 1839; and any person who feels interested on the subject may obtain a copy of the specification and drawings of this patent, from Messrs. Poole and Carpmael, of the Patent Office, 4 Old Square, Lincoln's Inn, London, on payment of 22*l.* 10*s.* (about $108,00.)

In Mr. Bigelow's patent of 26th May, 1842, his first claim is, the measuring roller *i*, &c., for regulating the giving-out of the warp

and the taking-up of the cloth. Our apparatus for this purpose is described at page 352, and represented at Figs. 161 to 164, where a measuring roller is shown, marked Q.

The second claim is only a modification of the first.

The third claim is, for the mode of giving uniform tension to each thread of weft or filling, by means of a finger or pusher at each selvage of the cloth, working in a groove cut in the lay; which fingers draw or push the weft thread toward the cloth at each pick of the shuttle. Mr. B. also claims the grasping of the weft thread at a point between the shuttle and the selvage of the cloth, by bars, or by a pair of pliers, in connection with the fingers for tightening up the weft, as already described. Both of these inventions are ours, and are included in our patents. In the beginning of the year 1834 we laboured under great difficulty in weaving heavy silk and woollen goods, the warps being of a sticky nature, and it was then that we applied these motions for obviating the difficulty. Some of the most competent manufacturers in France, who saw these inventions in operation, were highly delighted with them; and from the testimonials at the end of this work, it will be seen, that they were acquainted with these motions, in connection with several of our other improvements, for upwards of nine years previous to our leaving France, in 1841. See also Enoch Burt's patent of 19th August, 1828, page 403.

The fourth claim is comprised in our patents already referred to, and we need not, therefore, make any observations upon it here.

We have already made some remarks on Mr. Bigelow's counterpane loom (see pages 446 to 449), the patent for which is dated 30th May, 1842; and we would just state in this place, what we before hinted, that without the motions taken from Tompkins and Gilroy's loom, and from "Cross's counterpoise harness," the counterpane loom would be no loom at all; as it is, however, it answers the purpose very well.

We make the following extract from the specification of a patent, bearing date May, 1839, granted to us in the name of Moses Poole, of the Patent Office, London:—

"The *tenth* part of the invention consists, in drawing up or tightening the weft thread or threads at each and every throw of the shuttle, so as to prevent any loose threads or loops, or any other unevenness in the cloth woven, or being wove in the loom to which this new mechanism is applied, which, it must be acknowledged, is a matter of no small importance to the manufacturer; for it is well known that even in hand looms there is often the greatest possible

difficulty to the weaver, or person who tends looms, to keep the weft thread always straight, that is to say, that when the shuttle receives its motion from one side of the loom to the other opposite side, that the weft thread in the opening of the warp yarn will have the appearance of a crooked line, or zig-zag, in and out, or similar to a thread of woollen yarn ravelled or taken out of an old stocking; this has always been a source of the very greatest embarrassment to the weaving community, and more particularly so to the manufacturers of silk, woollen and such like sticky or gummy yarns; for, as I have before observed, the weft thread must be woven into the cloth in a very loose and imperfect manner, unless something is done to remedy that evil, and this is the case more particularly in looms worked by power. And I would further remark, that it is well known to all manufacturers and weavers in general, that there never has, up to this present time, been any effectual remedy found out to do away with the above mentioned evil, and particularly so in power looms; for it must at once be perceived by the most inexperienced manufacturer or weaver, that unless the surface or texture of the cloth or fabric woven is perfectly smooth and of a glossy appearance, something like the surface of a mirror, then the cloth or fabric will not be so good either in appearance or in substance. But by means of this invention or improvement, all these above mentioned evils will be annihilated, and done away with; the construction and adaption of which will be readily understood by every experienced manufacturer or mechanic who is acquainted with looms and machinery in general; neither is it subject to derangement in any way whatever, when once adopted to any loom or looms, whether such loom or looms are worked by steam or other power."

Then follows a description of the invention, including several different modifications of it, applicable to various kinds of looms; and the patentee further observes :—

"Having described the various parts of the invention or improvements in looms, the manner of their working is as follows, namely: as soon as the shuttle has entered the lay box, after having been driven through the shed as in other looms, and when the lay is about half its full course or distance forward towards the fell of the cloth, then the said finger or curved lever-piece will push forward the weft thread or threads before the warp threads descend or close together, and also before the reed comes into contact with the cloth."

The patentee next refers to the figures contained in the patent, and afterwards claims as follows :—

"Having now described the invention or improvement in looms, and the manner of carrying the same into effect, I would remark, that of course I place one motion at each selvage of the cloth, so that the weft thread will be drawn from each side of the cloth being woven; and I would further remark, that I do claim as the invention the arrangement of apparatus for the purpose above described of *drawing* or *tightening* the weft thread or threads of a fabric or fabrics, in whatever way the same may be applied, so long as the principle of the invention is retained, that of *pushing or carrying forward whatever part of the weft thread may remain loose, slack or kinked in the warp opening after the shuttle has received its impulse* as aforesaid, and I do also claim the application of the same to all looms, whether such looms are worked by steam or other power."

Although in all Mr. Bigelow's claims just referred to, we have, we regret to say, not been able to discover any new feature, yet this gentleman is the patentee of another loom, for weaving coach-lace by power, with Jacquard machinery, of which we have formed a very favourable opinion. We think this loom evinces much ingenuity in its construction, and is decidedly the best machine for weaving coach-lace yet introduced.*

The importance of the fine arts in connection with manufactures, has been so much felt in Great Britain, that the subject was investigated by a Select Committee of the House of Commons, in 1835; and the evidence then brought forward is highly valuable, being derived from the experience of some of the most eminent British artists and manufacturers. We have carefully examined the information thus furnished, and as it is well worthy the attention of all manufacturers of figured goods, we think it may very properly be introduced into this work. We accordingly proceed to quote the evidence of the late M. Claude Guillotte, and shall follow with that of other distinguished gentlemen.

M. Claude Guillotte, examined: I am a maker of Jacquard looms, and of all sorts of looms for silk manufacture, and of French bar looms, by Premaillerre, upon which (the bar looms) from ten to thirty ribbons at a time may be manufactured, and the whole of the machinery conducted by a young man. Of those, I manufactured 150, at several times, and for several parties; and they were the very first ever introduced to this country, and for which machinery I took

* A correct copy of the specification and drawings of this loom will be given in our promised work on carpeting.

out a patent. Jacquard machinery adapts itself to all sorts of tissue. I made three years ago the most complicated machine ever produced in England, with 4,600 threads, at a cost of 50*l*., and before it was put in order and set to work, it cost 100*l*. ($500,00); it was for weaving napkins and table-cloths, and was worked by one man. I also made many of the Jacquard machines, with 1,600 to 1,700 threads for smaller table linen. Of late, I am making Jacquard machines, by hundreds, for all parts of England, where they had not been introduced before. For Yorkshire, I am particularly engaged at present making them for merinos and damasks, and the same for Bolton and Manchester; I have agents at Manchester and Bolton; and I have been engaged in making them at Coventry for ribbons. There are from 7,000 to 8,000 Jacquard looms in operation in the country, and there has been an extraordinary increase in the demand; for the silk manufacture, I received in London orders for six, eight, and ten at a time; in Yorkshire, I received orders for from sixty to eighty at a time; and for worsted manufactures, the demand is also considerable.* The demand commenced about eleven years ago, and has become much more active of late in Yorkshire: and yet, I was four years ago in Yorkshire, at Halifax, Huddersfield, and the surrounding country, with an interpreter, taking with me half a dozen, and there was no individual willing to purchase one; and after my return, I received an order for one machine, in order to make an experiment; it succeeded, and the consequence was, an order from the same individual, a Mr. Gill, to manufacture more than 100 such machines, and there was a demand at any price from every body. These were to re-place the old mechanism, which was employed in producing small patterns; those are principally used for waistcoats. The demand could not of course continue so great as it was; but there is still a demand, principally for merinos and damasks. In Scotland I have an agent, but I do not do much, the price of the cards for the manufacture of Scotch shawls being *too high*. The difficulty of applying these cards to shawl-making is, that for the production of a beautiful pattern, 5,000 or 6,000 are required, which makes the machinery too expensive.† At Norwich, a good many were sold one or two years ago, but they are *expensive*, and it has prevented its being much applied to the *silk* manufacture. In Scotland, they use a draw-boy instead of a Jac-

* There are probably at this time (1844) 30,000 Jacquard machines in operation in Great Britain.

† For some of the finer species of shawls, now produced in Europe, as many as from 12,000 to 20,000 cards are used.

quard; in Scotland and Norwich, the number of cards which are necessary for the production of a figure make the employment of Jacquard machines much more expensive. Sometimes I employ foreign workmen in the manufacture of my machines, but they *leave me when they can better their condition;* and a good workman, such as I employ, will get thirty shillings ($7,50) a week. I think the price is lower here than it is in France, and I account for it thus: because I *carry on the whole of the manufacture in my own workshops;* while in France the production of a Jacquard machine is divided among the workshops of several persons.* There are only two principal makers here, but the competition between those two is so great that the prices are kept low. Many *inexperienced persons have made attempts to make the machines,* but have not been able to *compete with those who had more experience,* and they have failed in producing the article as cheaply as we do. I employ from thirty to forty workmen in Spitalfields. The operation of adapting the design to the loom is this:—First, the design or pattern to be produced on the cloth is drawn on paper, and exhibited for approbation; it shows on paper what it is intended to be on the cloth; as the threads are very minute, they are then as it were extended on another paper, design-paper, of a larger size, which shows the pattern as it were magnified, in order to place so many threads to the inch, perhaps twenty, that every square may represent a thread. This is what the French call "*mise en carte,*" and in English, "put upon rule-paper."† The next process the rule-paper undergoes is, to be read in, which transfers the pattern from the rule-paper, and prepares it fully for the stamping or cutting of the cards. The rest of the process is mechanical, consisting of punching holes in the cards, according to the number required, and applying the card to the machine. I have seen 200 boys employed in weaving the richest figures in the loom. To so simple a process is the principle of weaving now reduced, that even boys of *sixteen* years of age are set to weave the figures of so complicated a nature, as formerly would have required men of *thirty years' experience.* In some departments of this process, the manufacture is superior in *England,* in others in *France.* Plain silks, if manufactured with the same materials, the production will be

* This is not the case in France now, as every Jacquard maker of any note completes his machines in his own workshops.

† The term *designing* means in France, drawing the first outline of the pattern, answering to what we call *sketching;* and the term *mise en carte* answers to our term *designing,* or transferring the pattern to the design-paper

equal in England as in France; figured silks are equal, as respects the mere manufacture; and there are two points of inferiority, the designing and the *mise en carte*. One particular reason for inferiority in England, which has much struck me, is, the exorbitant *price of cards*. In the woollen manufacture, the cards which have been used for woollen goods have been returned to the Excise. A return of duty has been obtained. I think that, if the same thing were done with the Jacquard cards, it would have a tendency to diminish the price. Though, generally speaking, the price is about equal in the two countries; yet in the reading the designs there is this enormous difference; the average price in France is *three francs*, or half-a-crown sterling; in England, the price was a long time 15*s*.; it came down to 10*s*., and I now charge 8*s*. per hundred I attribute that to two causes, the presence of silk manufacturers, which has created a greater competition and a greater necessity for activity. This activity commenced in the year 1823, but since 1826 the activity and competition has greatly increased. The consequence of this competition has been also the introduction of a great many French designers to settle here. The French designer understands the *mise en carte* (putting on rule paper) *better than the English designer;* and the French *metteur en carte*, understands design better than the English *metteur en carte*. The reason that occasions this great difference between the *metteur en cartes* and designers of England and France, is, that the designers themselves are *obliged* to put it on the rule-paper, and *previous* to that go through *every branch* of the business (including the *weaving*), and this is undoubtedly the cause that they are more perfect. I do not mean to say that they design *better* in France than here; but there is a much greater number of designers of the same capabilities in France than here. In consequence of the *encouragement* the French designers receive, they are both more numerous and more talented, although there are individuals in England equally as clever, and with a profound knowledge of their art. The artist who draws the designs at Lyons is the artist generally employed to transfer them to the rule-paper. This person, whom I consider the *metteur en carte*, is only employed in that; he is inferior here. In Lyons, in a great number of instances, there is never a design drawn at all; but the first production of the design is on the rule-paper. The *metteur en carte* is himself an artist. It is in the *connexion* between the arts and the manufactures that we are inferior. In France a manufacturer employs from three to four artists, and in England one artist supplies from eight to ten manufacturers. An indifferent artist em-

ployed in painting the patterns on the ruled paper may be obtained for 50*l.* ($250,00) a-year, but there are men whose services are worth 400*l.* a-year, or even a share of the manufacture. The sale of the fancy trade entirely depends upon the *taste* and *abilities* of the *designer*. In France there are often only one or two artists who are paid, and who get from 180*l.* to 200*l.* a-year, but there are several who give their services for the instruction they receive. The *metteur en carte* should be well instructed in designing. He should also be acquainted with manufactures in theory and in principle. They are so at Lyons, but they are not so in Great Britain. The Jacquard loom was *first adopted at Lyons after the Revolution.* Before the invention of the Jacquard machine, eight or ten years were required to make a good workman; afterwards six months were sufficient. For ten years after the discovery, the machinery remained with very little influence, but designers increased with the introduction of the machine. From the year 1808 to 1810 the machine was brought into activity, but at that period it was very *imperfect.* In 1814 it was *much improved*, and in 1815 it was fairly established. When France possessed the *monopoly* of the Jacquard machine, it gave her great advantage in other countries. France has only by great exertions produced better and cheaper than they. There is a school of design at Lyons. The young artists have since the discovery of M. Jacquard particularly turned their attention to the *mise en carte.* There has been a great augmentation of such young artists; indeed, there were no such artists before; for it was found requisite to set up Jacquard machines in the school of design. This lasted two or three years only; they now obtain the required knowledge of the loom out of the school. The discovery of the Jacquard loom infinitely multiplied the number of young artists, who devoted themselves to the *mise en carte.* The great advantage of Jacquard machinery, is this, that it enables that to be done in a few weeks, which before occupied months; and that the change of a pattern formerly was a long, laborious, and costly affair, and now it is a very simple one, and may be done in a few minutes after the completion of the reading and the stamping or cutting of the cards. In France, in ordinary cases, our artists receive *six months'* instruction in the theory of the manufacture before they are called into the field of practice, after they have been instructed in the school of design at Lyons; or artists, during their instruction, must pass two hours a day to understand the theory of the application of the design relative to the machine. There are *private instructors* who give those lessons in the *school of design* at

Lyons; they also give instructions in the *mise en carte*, making their talent practical. The English copy the good French patterns and the French copy the good English patterns. The best English designs are those on cotton goods; but the English do *not understand* the *mise en carte*. We sometimes make good copies from English patterns for the Spitalfields looms from the English printed muslins, but it requires taste and knowledge to arrange them. The French manufacturer can come with patterns every year to England, bringing with him samples of them on the cloth, whilst the English manufacturer only brings it on the paper; the cause of that is, the French manufacturer employs weavers who are *solely* engaged in the production of patterns, and as the pattern on the cloth shows more distinctly the effect than the drawing on paper, it gives them an *advantage* in the *market*. There are individuals who are engaged, and who collect at Paris the patterns in vogue there, which they bring and dispose of in England, and they also carry to the continent such patterns as they can collect here for the purpose of sale. These only serve as mere ideas; in the execution of the working drawings the French *improve upon us*. If there were a school of design established in London, its effects in three years would be so to equalize the manufactures of the two countries, that the country in which they were produced would not be *recognisable*.* The principal difficulties in the way of improvement in the *silk* manufacture are, first, *the high duty on paper*. The high price of paper has this injurious effect, that the manufacturer is very unwilling to change his patterns. There is a difference between the cost in France and England; it is as *one* to *four*. The English card is superior to the French; but that makes little difference, because it is never worn out, a new pattern being always introduced before the cards are damaged or worn. The two disadvantages I consider are these, *the higher price of the cards*, and *the inferiority of the metteur en carte*. With respect to colours, I think, in a great many cases, where there is an apparently greater beauty in the French dyes, they are *much less permanent* than those of England, and I have seen many examples where, after a few weeks' wearing, the French colours have *wholly faded*.

"I take the liberty of making the following remarks about designing and *mise en carte;* for as this is the very head part of all that

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* French patterns have still the ascendancy in Great Britain (1844).

belongs to the weaving department, and, at the same time, is the very *least* cultivated in this country, it is *before any thing else the most worthy of your attention and consideration.* For as long as this branch of the business is not highly improved, and proper schools for design and *mise en carte* erected, and children, who already have acquired the practical and theoretical part of weaving, are engaged and trained up in this art, France will *always* have to boast over England of the honour of sending *more fancy patterns, and finer and more beautiful workmanship*, and, in fact, brought to the *highest state of perfection.* But, on the contrary, if it should meet with your Honourable Committee's approbation, and get encouragement to bring it into fulfilment, and to get such schools erected in some quarter of Spitalfields, or its arrondissement, there is no doubt whatever, that the English manufacturers will soon rival, if not altogether equal, the French manufacture, and thus throw off the *shame* of seeing foreign manufactures surpass the English in quality and workmanship.

"Your very humble servant,

"CLAUDE GUILLOTTE."

Mr. Robert Harrison, examined: In designs and patterns in the silk trade we are very inferior to the French; and that is the principal difficulty under which we labour at the present time. We have not been able to find persons in this country who are capable of giving proper designs; the principal difficulty arises from the circumstance of men not having been brought up in this country to design for silk; *it is very different to designing for printers, from the circumstance that it is necessary a man should be conversant with the principle of weaving before he can make a proper design for silk.* If we could only get designs in this country, we should be able to find parties that could put them on ruled paper for weaving. There is nothing but what we could make, provided we had a proper designer for the purpose of drawing patterns for weaving; and I think the principal difficulty arises from the circumstance of not having any school of arts in this country, where young men would be enabled to pursue their studies for the purpose of perfecting themselves in drawing for that particular branch of the manufacture. There is no want of talent in the country, because there are a great many persons engaged exclusively in the production of designs for printed cottons, challies, and bandannas; *we have in the trade individuals who can draw patterns, but are not conversant with the principle of weaving*, and therefore we

have been *unable to put those patterns to work.* We have now many patterns by us which are perfectly useless, because the drawing is not adapted to weaving. We would *willingly, at the present time, engage a man at a handsome salary, conversant with the principle of weaving, as a designer, and also able to put the pattern upon paper.* Foreigners are not superior to us in their colours; there is a brightness in their colours we certainly do not possess, but I think our colours are more permanent. The dyeing of colours has certainly improved within the last few years, and in many cases, the permanency of colours decidedly is more than the French. It is necessary to have a perfect chemical knowledge before a man can be a good dyer. I understand the peculiar brilliancy of the French colours arises from the climate more than any thing else, and the water has something to do with it as well. It has occurred to me, if we had a school of arts established in this country, that a great many young men would be willing to make themselves conversant with the principle of weaving, for the purpose of procuring that particular study, and ultimately to become designers and drawers upon ruled paper for the silk trade. It would be a *lucrative* profession.

Mr. John Howell, (of the firm of Howell and James, Regent street), examined: The manner of choosing our patterns or goods is as follows: it is usual for the Lyons manufacturers to come twice a year to England, that is, in the spring for the autumn, and the autumn for the spring, and they produce perhaps 200 or 300 patterns, not paper patterns, but silk patterns or gauze patterns, or whatever it may be, and from these patterns we make our selection; and it sometimes happens that we have so good an opinion of certain patterns, that we say, "You must withdraw that, it must be made for us only," and for 20 or 30 pieces they will do that. Now the English manufacturers never give us that advantage, they think it very expensive to put to work a pattern to show us the effect of it, for it looks so different on paper to what it is in reality, that we cannot decide whether we shall have it or not, and we often urge them to bring us a little piece ready, to see the effect of it; sometimes we want colour, sometimes we want a little change in the disposition; but there has always been an objection to the expense incurred, and therefore we are obliged to bear the expense if we are content to order from a paper pattern; we have sometimes found it necessary to ask for a pattern-drawer or designer; not a pattern-drawer because they are distinct businesses. *I never found a good designer in England;* a pattern-drawer is a different thing altogether; he

is the man who puts the thing comparatively to work, as an architect designs the building of a house. *Neither have I found a good pattern-drawer;* the designer gives us a small pattern, and the pattern-drawer is the person who prepares the work; as an architect gives a drawing to the builder, so does the designer to the pattern-drawer. I think that there are not so many persons capable of doing it in this country as in France; the pattern-drawer is the medium between the designer and the weaver. After the Peace with France, I found the manufactures of that country were superior to those of England; I mean in regard to silks of all descriptions; but I think a great deal of that arose out of having made use of better material; the natural silk of France has been considered better than any other country, but now we have an importation of that natural silk, and it is manufactured here. The importation of raw silk from France, by reason of its superior quality, has beneficially acted upon the English manufacture; I found their silks better the moment I had an opportunity to go and see them; but I have found them declining every day since; every time I go to France, I find the French silks are not so good as they used to be in point of material and workmanship; they appear to be desirous of a large trade rather than a small good trade; the English manufacture has improved in a greater ratio perhaps since then. France is superior to us in design; but it is confined to very few houses; there is only one house at Lyons we can deal with largely, because their taste is always superior; I am speaking of design. We keep all our patterns; *patterns fifty years old are very useful to us at this present moment.* The French pay great attention to pattern shawls; they will give three or four hundred pounds for a Cashmere shawl, or India shawl, *for the sake of the pattern.* The shawls that were exhibited at the Exposition in France were superior to the India shawls; the patterns more perfect.* Their patterns are superior in the manufacture, as well as combination of colours and design. It is all superior. I believe they have a superiority of machinery in the manufacture, and execution as well. Will the Committee allow me to exhibit some pieces of paper, to elucidate the connexion between silk and other materials, the manufactures of this country? It shows how the introduction of good patterns will give a taste or style to other materials; it is intended for rooms in lieu of silks; and instead of costing two guineas and a half, a yard would only cost 2*s*. 6*d*. The inventors are De la Rue and Com-

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* See Cashmere Shawls, pages 268 to 275.

pany, Bunhill-row.—(*Mr. Howell then produced to the Committee patterns of various colours.*)

Mr. Thomas Field Gibson, examined: I am a silk manufacturer in Spitalfields. The description of figured silks which we are now making in Spitalfields are of a very small and insignificant kind; they are not of the large class of patterns. That is the general class of patterns that are now making. They are almost entirely *copies* or *variations* from French patterns; there is but a very small degree of talent employed in Spitalfields in the production of patterns. *We are almost destitute of original taste* in that particular department. The French patterns are generally given to the pattern-makers by the manufacturers, and they either copy precisely, or make variations as the manufacturers, or their own taste may suggest. I am not acquainted with any drawer of patterns who is an educated artist. A good pattern-drawer may obtain from 100*l.* to 200*l.* a-year; but the remuneration varies with the description of pattern. It is also mixed up with a remuneration given for reducing the design to the mould, or cutting the card, which is necessary for the weaving it in the looms. I think that the two difficulties under which we labour at present, are, first, *that we have no protection for patterns*, so that if I make an outlay of from 20*l.* to 100*l.* upon a pattern it may be pirated to-morrow by my neighbour, and I should have no compensation for it; and the second difficulty is, *that we have no national taste in this department of art, that we have no originality in design of drawing of patterns*, that we are *compelled* to make copies from French patterns in order to supply the demands of our customers. I think a school of arts open to persons connected with the manufacture of this country would be of high value and importance, coupled with the protection of patterns; but without a protection of patterns, no school of design would be of any advantage to us. It is not to be expected that the master-manufacturers would undertake any part of the expense of such an establishment. The utmost that could be expected from them would be to give their time and attention to the arrangement and working of the system; and I believe the fact is, that in France the Government, or the municipal authorities, or both together, do pay for the whole cost of the establishment. If the *general taste of the nation was improved*, it would be beneficial to our manufactures; and I would add that ours is a manufacture which is capable of such extreme variety in shades of colour, in the blending of shades, and in producing various forms of pattern, that there is hardly any one to which the exhibition of all works of art

in which colours are concerned would be more beneficial. A protection for patterns should be for not less than twelve months. I can give a reason why a season or six months would not be a sufficient time. I was manufacturing a pattern in silk during the spring, to the order of a large house of business in London. I received orders from them to continue the manufacture of the same pattern in autumn colours; but in the last month this pattern was taken to Manchester and manufactured there. The order which I had received for the winter article was immediately countermanded, because it was produced at Manchester at a much less price. A HEAVY FINE SHOULD BE INFLICTED FOR PIRACY. Sometimes there are more than 100 pieces of the same pattern. It more often happens that there are less than 100; more often than not. According to the average returns from the Chamber of Commerce at Lyons, the number of pieces made of fancy goods of particular patterns does not exceed 20 from the loom; what is the average production of England of the same manufacture, I have no precise knowledge of—but I should say double, at least 40 pieces. In French silks, in some cases, a very large profit is paid to manufacturers on condition that they shall produce a small number, and then destroy the design. A pattern should be protected by registering the actual pattern. With regard to printed goods, the custom is for the parties to print on the end, "engaged for three months," and after that period it may be copied by any body; that would be a sufficient protection if it was extended, as I said before to *twelve months*—whatever registration took place should be a public and authentic one. The registration and location of patterns, representing the state of perfection in the particular trade, would be in itself a great means of advancing and improving the manufacture. There are no superior weavers solely employed in weaving patterns, and there is a good reason why this is so; a weaver could not himself produce the pattern to the manufacturer in the same way as he does at Lyons, because in London he is not possessed of machinery by which he could do it; the machinery belongs to the master-manufacturer here, but in Lyons it belongs to the weaver. I have heard that in France after the design has been produced, the weaver introduces a considerable modification into the pattern itself.

James Skene, Esq., Secretary to the Board of Trustees for the Encouragement of Manufactures in Scotland; also, Secretary to the Royal Institution for the Encouragement of the Fine Arts in Scotland, examined: My opportunities of acquiring information with regard to the advantage which manufacturers may derive

from an increased knowledge of the arts of design, have been during the greater period of my life; I was educated abroad, and stayed in one of the foreign academies for three years, when a young man, and since that period I have been about ten years in different countries, and being fond of art myself, I have paid considerable attention to the subject. The Board of Trustees was instituted at the time of the Union of England and Scotland; in consequence of some alteration that took place in the customs and duties connected with the two countries, a sum of money became due by England to Scotland, payable to different establishments and different individuals. The surplus of that sum was appointed by Government by the 15th article of the Treaty of Union to be employed in all time coming for the encouragement of manufactures in Scotland. That was the origin of the Board of Trustees in the year 1707; at that time an annuity of 2,000*l.* was appointed to be paid for seven years to the Board. That was the first grant. The Board, nevertheless, was not established till the year 1727; there came to be accordingly arrears of that 2,000*l.* for seven years, which made 14,000*l.*, which was then paid to the Board, as also a sum of 6,000*l.* of farther arrears after the annuity had been made permanent, and laid the foundation of their funded property. The grant of the 2,000*l.* was then rendered perpetual, and they have ever since received that sum. Various alterations have taken place in their proceedings, and their funds have been considerably augmented; some of their funds being in the public securities during the war, and exceedingly well managed, considerable savings were obtained by that means; so that now their funds consist, in the first place, of the annuity of 2,000*l.* payable by government; they have the sum of 30,000*l.* at present in the hands of the Water Company of Edinburgh, for which they receive the interest; they have 15,000*l.* in the hands of Mr. Innis, of Lochalsh, also yielding interest; they have a sum of 1,000*l.* in the hands of the town of Edinburgh, which at present yields no interest, as the town is *bankrupt.* They built the Royal Institution, a large building in Edinburgh, for the purpose of accommodating various learned bodies there; the Royal Society, the Royal Institution for the Encouragement of Arts, and the Institution for Antiquities (the Antiquarian Society, as they call it), and also for the accommodation of the Board itself; they receive rents from those other societies which amount to the annual rent of 740*l.*: that constitutes the fund. The principal means which the Board have followed for extending the knowledge of the arts among the people of Scotland, has now been in operation for about seventy years: about

seventy years ago they established a school for drawing, being aware of the advantage which *foreigners* possessed over this country as teachers of design *at that period*, they got a person of the name of De La Croix, a Frenchman of considerable skill, who set that institution a going; it was for the accommodation of forty pupils taught by one master, and the pupils are admitted gratis. They offer specimens of their capacity, and certificates as to character to the Board of Trustees, and they judge of those who are to be admitted, giving the preference to those who seem the most deserving of it. It is an establishment which very soon rose into great repute in the country, and has continued exceedingly successful ever since. The number of pupils has remained stationary, with only one master. It has been managed since its first establishment by a series of very eminent teachers. The person who now holds it, Mr. William Allen, is the first artist in Scotland. The Board contemplates extending it, and they are at present taking measures for that purpose. Hitherto it remains on the same footing, only forty pupils, but so great is the demand of the public for the extension of it, and so high it stands in their estimation, that although there are about four or five elections in the course of the year, there generally are at least ten candidates for every single vacancy that occurs, and it comes to be a matter of very disagreeable administration to the Board to reject so many young men from having instruction in the art of design, when they seem desirous to obtain it. The pupils are principally engravers and statuaries, also artists, coach-painters, house-painters, and manufacturers; persons of that kind. Mr. Wilkie, (Sir David) was educated there, Mr. Barnet, Mr. Wilson, Mr. Allen himself. I believe there is not an eminent name in the history of art connected with Scotland where the individual has not been educated at that academy. It has produced the most eminent men, either as artists, engravers, or as connected with any of the corresponding professions; *in fact, it has done a world of good to the country.* The candidates produce specimens of their talents for drawing; they produce certificates of their good character; the Board is very particular upon that subject: also if they are apprentices they produce certificates from their masters that they will give them the means of attending, and then all these are examined by the Board of Trustees; and that young man whose name perhaps they are ignorant of, but that young man whose qualifications seem best, is the person elected. The only preference they seem disposed to give is to the younger classes of them in preference to older ones. The Board of Trustees also established a

branch school for the express purpose of teaching the pattern drawing for *table-cloths*, *diaper*, and matters of that description, at the town of *Dumfermline;* it was upon a particular system, and the Board engaged to give 50*l*. a-year to a master, provided the manufacturers of Dumfermline would contribute an equal sum. They did so, and that school was in operation for a good many years; I do not exactly recollect the number of years, but for a good many years, and was exceedingly beneficial, and, in fact, was one of the great causes, in conjunction with the encouragement of premiums for the best articles of manufacture given annually by the Board, of raising the establishment of linen manufactures in the town of Dumfermline. Last year the manufacturers declined contributing any further to it, because it had been reduced to a few only, who contributed their proportion, and these few, two or three of the manufacturers, said the burthen was too hard upon them, and they could not contribute any longer, wishing the Board to advance the whole sum of 100*l*. That was incompatable with the idea the Board had of ensuring the establishment which they fostered, being one beneficial to the manufacturers themselves, that they should give the whole sum, and therefore they declined giving it, *and that school has accordingly fallen.* They found it advantageous, but the whole body of them were disinclined to contribute to it. There were two or three who continued to contribute to the last, but they found 50*l*. a year was more than they were disposed to give. The master could not undertake it under 100*l*., and the Board was not inclined to give above 50*l*., which they originally proposed. The designs of French shawls are almost confined to the Indian patterns; but I believe it is the general opinion, that the French have *exceeded even in that respect the English in their patterns; because they have turned their attention to it in a more efficient manner.* There is a school at this moment in Paris, where about seventy pupils are instructed expressly in that particular branch of shawl patterns, taught by a person *who has written a pamphlet on the subject;* and I believe the price of their shawls is under that of this country. I am not awaie whether the Mechanics' Institutions there give any instructions of the kind; but the Board of Trustees being aware of the deficiency in that respect, has now sent an exceeding clever artist to Paris, for the purpose of gaining information upon that subject, whom they mean to introduce to the Academy at Edinburgh, and to establish a class for that especial purpose, not for teaching shawl patterns alone, *but patterns in general connected with manufactures.* It appears to me that the best footing to

establish those would be to have a system of instruction; a centrical establishment upon a regular system, which should not be deviated from in any respect; I have not any doubt that in a very short time a number of students would be raised in that centrical establishment, who might then be sent to the different parts of the country where they might be required, and establish branches in communication with the centrical establishment, and under the same regulations and the same superintendence. That at the same time would serve not only as a school for instruction, but also a kind of *haut ton* for the most recent improvements in all the different combinations of art connected with manufactures.* I should be disposed to extend it pretty far in that respect, particularly to make it an establishment of different classes. One of the great defects in the mode of instruction in this country, is, that the first branch of art, namely the fundamental one, is that which is neglected; that is, what is called *drawing from the round;* it is, in fact, the rudiments of design, the *most indispensable*, although the *most neglected;* except the Royal Academy and that Academy of the Board of Trustees, I am not aware any other teacher of drawing does really adhere to that system, which I know in French academies to be the only system that is taught, because they conceive; and it has been the opinion, I believe, of artists for many generations, as well as the old masters, that this is the only species of study which is requisite to form an artist. If he has once acquired a knowledge of drawing from the round, or drawing from objects of beautiful outline, and containing means of light and shade, that he is enabled then to turn his talent to any of the branches that he may require without any further instruction. In this country we seem to take a secondary part of it; to take instruction in a more advanced part, and neglect the rudimental part. In correctness of drawing the human figure, and in the knowledge of proportions, we are very deficient; and on

* An establishment on this principle has been erected at St. Petersburg, in Russia, under the especial protection of the Emperor Nicholas, where all the new improvements connected with manufactures, introduced from Great Britain, France, Belgium and America are tested by actual operation; and as soon as any improvement gives satisfaction, it is forwarded to those parts of the country where it is considered likely to prove most advantageous to the national interest. Our friends, Messrs. Sanford and Varrell, machine-makers, Paris, (France) informed us, that they had examined this establishment when in Russia in the year 1840; and in their opinion, the plan is a most excellent one for advancing the manufactures. These gentlemen further informed us, that the concern was conducted by the most talented mechanics and manufacturers, from Great Britain, France, Belgium and America. See page 424.

that account I would make it a rule of that establishment, that the first class should be that one in which instruction is given in chalk drawing on a large scale from the round, having a series of second classes where the different branches connected with the useful arts were taught, which covers very many; architecture and all other branches connected with the useful arts, ornamenting, decorative, house-painters, and so on. I would not only make the fundamental principle (correctness of design) the object, but also what may be termed the perspective in botany, and those parts which are connected with certain sciences which may be called positive parts of art. It appears to me, a very little instruction, perhaps a few lectures, on this, as far as it is applicable to the useful arts, would be sufficient, that is, on anatomy, chemistry, optics, with reference to colours and botany. It appears to me there is a very great defect in general in our patterns, in botanical accuracy, where flowers are introduced; *the foreign pattern-drawers are uniformly correct; our pattern-drawers very seldom so.* I would have a third class for the higher branches, and for the purpose of artists; but that confined alone to men whose object in life was to be artists. I would have a certain subdivision of instruction, so that pupils coming there, and wishing to devote themselves to the study of casting in bronze or in iron, or studying modelling silver, or turning themselves towards pattern-drawing on cotton or on silk fabrics, might have the means, after a certain time, of devoting their undivided attention to any particular branch of that kind, comprehending the requisite acquaintance with the manufacture itself; so that they might go out from the institution, having chosen that division of the subject most suited to their capabilities; they might go out as manufacturing artists, to accomplish the particular object which they felt themselves most particularly qualified for. And the purpose I should have in dividing it into classes, would be this, to, in fact, repress an error which those academies are exceedingly liable to fall into, and which the academy of the Board of Trustees in Scotland has already fallen into; that is, *of neglecting those parts of the study which apply to the useful arts*, and dedicating their attention alone to the higher branches; in fact, making all the pupils study as artists, and not as men to pursue useful branches of occupation. It is an exceedingly dangerous thing to pursue, in such institutions, those portions of art which may be said to be connected with individual taste or individual genius, since the tendency of so pursuing them *must be to neglect those portions of art which are positive and true*, and founded upon invariable principles of art. I consider that the division

into classes might prevent this tendency; because, if the first class is imperative that no pupil could enter the academy without going through a course of the first class, then he would be enabled to turn his talent to any branch of design he might choose; he may then quit the academy. If he chooses to follow out the pursuit to the highest branches by the recommendation of the master, he may be permitted to do so; but it has been experienced in those academies in Scotland, that many pupils who come there with a view towards the useful arts, have quitted it and become artists themselves. At the Academy in Edinburgh, where forty pupils are taught, the master receives 150*l.* a-year, and there is an officer receiving 50*l.* a-year; and with taxes and lighting the fire, and so on, there are some other expenses, but of no great importance, and that is the whole amount of it; and supposing subordinate schools were established at Glasgow, Paisley, Kilmarnock, and other manufacturing towns in Scotland, I should conceive that a sufficient master would be found at 100*l.* a-year to carry on the establishment. It would not do for a master, at certain times, to make circuits through the manufacturing districts, and give instructions for three months, or some such period. Drawing requires a little time; and although it does not require very great labour on the part of the master, it still requires a certain degree of superintendance; that he sees what the pupils are doing; but it appears to me, the more numerous an academy is, the more advantage the pupil derives from it, because he improves *by what he sees his neighbours doing;* it does not require much labour on the part of the master, but it requires a person to be able to correct where errors occur. In that school of forty pupils I have not any doubt, that, at any period, six or eight might be drawn from it perfectly capable of teaching the art of design. On the supposition that these establishments were formed and connected so with the mother establishment in Edinburgh, publicity should be an essential ingredient of all their proceedings, and the state of the school, the number of pupils, and accounts of the funds, should be annually laid before Parliament. It would interest the public on the subject, *and the interest of the public is very much wanted.* Reports of our academy are made to the King, that is to say, to the Treasury. They are not made to Parliament at present, but they might easily be extended to Parliament. The Board established prizes for pattern-drawing in their academy, and a good many very creditable specimens have been, within two or three years, produced; but there is one deficiency there, which shows the necessity of teaching for that matter, which is this; *that many of those patterns which were*

exceedingly beautiful, were not altogether adapted to the operative part of the manufacture; the persons were not conversant with looms, not conversant with manufactures in fact, and therefore they require the means to be provided of having recourse to a master, who can instruct them in the working of the fabric, whatever it may be, to which their pattern has been employed. *In France,* the workmen is *more an artist than in this country.* The system in France is very different, *because there the artists of the first eminence employ themselves, and make it the most profitable part of their time in pattern-drawing, and they are paid a very high price by the manufacturers.* There is a legislative protection to their work, which in this country we have not, and yet it is of great importance; so that for a year (I believe that is the period) both the manufacturer and the artist is quite sure of his pattern not being pirated. It appears to me, that some legislative interference in that matter would be almost necessary to go hand in hand with any establishment for encouraging the art of design amongst the middle class of society in this country, that they may be protected in the production of their genius; otherwise neither the manufacturer can afford to risk the loss of the pattern, or to pay a large sum for the pattern which he may lose, nor can the artist risk it. On general principles it would be exceedingly desirable that a speedy and cheap remedy should be given to the inventor of a design; a small sum to be paid for the right of proprietorship. It appears to me that one thing in which the British manufacturer is most deficient, is that of a knowledge of colours; at present, as far as my acquaintance with manufacturers goes, I believe *they copy entirely their patterns from France;* in doing so, *if they introduce any alteration into them they often spoil them;* and it is a matter which is not a very difficult one to obtain a knowledge of, the theory of colour; but it is one which appears to me a very singular circumstance that it is not sufficiently attended to, because we know quite well that any deviation from the regular established and fixed rules of harmony of colours, produces the same effect to the eye as any deviation in music from the harmony of notes. It produces an equally bad effect; and in placing our manufactures or fancy goods along with French fancy goods, it has often struck me as a remarkable circumstance to see how very little those rules which are exceedingly simple, are attended to in the English copies. That was my reason for suggesting a lecture on that part of the subject, on optics, in fact, on colours, at those schools; for the rules are simple, but quite necessary to be known to any person who has occasion to place colours in juxtapo-

sition. The funds of the Board have been very much reduced this last year; they are now exceedingly small, but they are at present engaged in measures for the extension of that very object, because it appeared to the members of the Board that that was the most essential requisite for the improvement of our manufactures, because it is obvious to every one that in point of excellency of workmanship the British manufacturers have risen to the highest pitch; *it is only in the taste of design in which they are deficient;* therefore the Board of Trustees have particularly directed their attention to that subject, as their funds have been so much reduced that they do not see they have the means of doing much else. In the course of this ensuing winter I expect that a good deal will be done on the subject. The French pattern-drawers have the flowers before them. I believe, in this country, when they do make patterns, which is not very often, they take any book of travels, containing flowers, which may or may not be correct; but I know the French artists copy from the flower itself, and that, being in the hands of skilful persons, *it is always botanically correct.* Academies might not only be connected with botanic gardens, but also, to a certain degree, with institutions in surgery; for instance, anatomy and other branches connected more particularly with science and art; how it might be brought about, I am not quite aware, except by employing persons; there are only professors; I am perfectly persuaded of the advantage that would arise from it: I think the improvement in matters of taste in general has been very remarkable in Scotland within a few years, and in dyes there has been a very great improvement; since the Board of Trustees have given premiums for that special purpose, there has been a very conspicuous improvement. In patterns the improvement has also been obvious, but not so very great as yet, because there is no instruction given in it; the young men who present these specimens of drawing are left to themselves, and they frequently go wrong in many particulars; it appears to me there is a great deficiency in the want of instruction. The Board of Trustees give 24*l.* a-year to be divided into prizes for the young men. There are six prizes for ornamental drawings, and six prizes for drawings from the round. The young men produce the first and the last of their performances during the season, in order that the Board may be able to compare their progress; and these are kept in the possession of the Board, not returned to the young men. They are also exhibited to the public. The prizes given by the Board of Trustees for improving manufacturers' patterns, are very numerous, and vary from year to year, according as the state of manufactures and the

state of the demand for manufactures seem to require, also according as it appears to the Board that there are particular branches of manufacture which might be conveniently and advantageously introduced into this country; therefore the premiums which they have offered have varied from year to year. Their principle is that they shall not continue to give premiums for a longer period for the same purpose than what is quite sufficient to introduce it; when once it is introduced they suspend the premium, *because they consider that if it cannot maintain itself after that, it is not worth encouraging.* Formerly there were a great many premiums given for the purpose of the linen manufacture; these have now been suspended. There are many premiums given for the woollen manufacture; for all the branches of that manufacture. Within these two or three years the Board have particularly turned their attention to matters connected with woollen manufactures, to the branch of carpet manufacture; and they have been the means of very much extending that branch in Scotland by the introduction of three or four new descriptions in the branches of manufacture which never were known in the country before, never practised in Scotland at least, and which have been most successfully introduced, and are now rising into great reputation. They have also turned their attention particularly to the subject of the *shawl manufacture;* a number of their premiums were dedicated to the shawl manufacturers, and amongst others, being aware of the disadvantage which the shawl manufacturers were exposed to from drawing the yarn used in that manufacture from France, and from France alone, because it was only there where it could be spun, the Board of Trustees offered a high premium for the introduction of the art, and have succeeded in introducing it; and it is now established in Glasgow and Leeds to an extent which I believe supplies the market as quickly as the French agents did, who do not come now to this country for that purpose. The amount of the premium was 300*l.*; it was the largest premium which the Board ever offered for any subject, and they consider they have done a very great benefit to the country in having succeeded in that scheme. They have introduced the system of making *carpets* in imitation of *Turkey carpets,* because they are made of coarse wool, which is more suitable. Their view was the consumption of Scotch wool, which is coarse wool compared with the wool of England, Saxony, and other countries; the view of the Board was to extend the market for the Scotch wool, and therefore they introduced the manufacture of Turkey carpets, which has been exceedingly successful, and has very much increased the consumption of that staple of Scotland.

They then extended it to the *Persian carpet*, which is a different fabric also, *and that has also been successful;* there are a great many looms now employed solely upon these branches. I cannot altogether say, but I believe the carpet manufacture has very much increased in consequence of the introduction of all those different branches. They introduced also the *tapestry mode of making carpets in imitation of French carpets;* they also introduced the making of carpets from *cow-hair*, which is an article that formerly was not used in any shape but in that of mixing lime; in fact, it was of no use; the premium was offered about three years ago; the yarn was spun generally in the gaols and correction-houses, and those sort of places, by the people who were there; and carpets have been produced of *exceedingly good workmanship*, and very useful for many purposes, particularly for shops and for lobbies, and purposes of that kind. It is a coarse manufacture, but a very useful one; *it is altogether peculiar to Scotland;* the idea, in fact, occurred to myself; I had seen the use of cow-hair in making rugs and things of that kind in Flanders; and I suggested that improvement, and it has been adopted. This improvement applies to the texture; the design is that of the Turkey and Persian carpets, but that has improved the art of design a great deal, because being a new subject, the artist has bestowed a good deal of attention on the subject. The French design is what is called "tapestry carpets," which has also been introduced into Scotland. The Scotch have now imitated that French pattern, I think with very considerable success. Those require *botanical accuracy* above all things, because they generally are groups of flowers thrown on a dark ground; and there is a much greater variety of shades of colours. Formerly in the Scotch manufacture, and I believe in the English also, they could not introduce above *four* colours, except by mixing the threads; *except by mixing a thread of two different colours.* I know that from a circumstance that was mentioned to me by a colour manufacturer in Scotland; he had arrived to the extent of introducing *fourteen* colours, or tints, which was conceived to be impossible; however, he is a very ingenious man; his name is Whytock,* and he set himself to work, and he has very much augmented the number of colours now introduced into patterns. In that respect, and in the circumstance of design and the beauty of execu-

* A description of Mr. Whytock's inventions in this manufacture is given at pages 215 to 239; which see.

tion, I think he stands pre-eminent. He has obtained a patent for the velvet carpet. The Royal Institution is now connected with the Board of Trustees, in consequence of an arrangement which took place about four years ago. Therefore the Board of Trustees have obtained access for their pupils to the library containing works on the fine arts, and every thing connected with that subject; they also have the privilege, for the pupils of the academy, of attending their gallery of pictures, and copying pictures there and studying as they choose. The institution have no casts; it is merely confined to pictures; it is a private institution supported by private subscription, and they have expended the whole of their funds in the purchase of the pictures of the old masters, of a collection, not a very large one, but an exceedingly good one, of paintings, which is now open to the pupils of the academy of the Board of Trustees. The gallery of casts consists of about one hundred excellent casts of the finest works of antiquity; they have also the Elgin Marbles, and have received a number of presents and legacies of different works of the same character. They obtained the originals from Lord Elgin; a great many of the casts which he had taken at Greece of different buildings, which are now in the collection of the Board of Trustees, are open to the public; to the artists always; to the public on certain days, but always to the artists, and always to the pupils of the Academy at all times. Exhibitions of works of art, such as ingenious patterns and manufactures, or ingenious specimens of weaving, were, at one time, contemplated, but never put in practice. I understand that there exists an indisposition on the part of persons who have made inventions or improvements to exhibit them, from the circumstance that they are aware that they have no protection; that their invention and the property of their improvement is *not protected*. The Trustees for the encouragement of the manufactures of Scotland, offer annually a series of premiums for improvements in different manufactures, also for inventions, should any take place. Those are annually exhibited to the public, and judges are appointed from among the manufacturers, who examine the goods and award the premiums. The circumstance that induces the manufacturers to attend very much to that is, that by obtaining the premium for their manufacture, they may obtain the means of publishing, very much to their own advantage, the species of trade that they carry on; otherwise the premium is a very small one, and scarcely worth the while of manufacturers to work for it. The French Exposition is highly advantageous. Where it enjoys a very great advantage over any attempt in this

country, is, that the improvements of the year, and the inventions of the year, are by the French manufacturers expressly reserved for that exhibition, because they know that they are safe in producing their new design, whatever it may be.

Although the evidence above quoted was given before the House of Commons about nine years ago, we do not think it has lost much of its value. We are not aware that any considerable change has taken place since then on the subject of which it treats. It furnishes a clear exposition of the state of European manufactures; which could not be done by any but men of liberal and enlightened views. There is no narrow-minded boasting about *native* talent; no depreciation of *foreign* ingenuity. Facts are truly stated; and honour is justly awarded where honour is deserved. We admire such sentiments, and wish that all could admire them: but we regret that national prejudices and national animosities have taken such a deep root in the public mind, that probably ages will elapse before they can be thoroughly eradicated.

DESIGN PAPER.

It is our object here to afford the manufacturer and pattern-drawer a *guide* in the selection of proper paper for his designs, as much depends upon the paper used, the due proportioning of the pattern, the nature of the fabric, the arrangement of the harness, &c.

The first thing to be considered is the fineness of the reed and the description of harness to be used, whether a full or one-thread harness, a split or two-thread, or a four-thread, or any coarse description of harness, such as damask, &c.

The second thing to be considered is, the thickness of the cloth or number of picks or weft threads per inch, and what proportion that bears to the number of harness-twines or mails per inch; and the paper must be selected according to that proportion, always bearing in mind whether the work be *once, twice, or oftener drawn*—that is one, two, or more picks or weft threads given to *the same card or lash.*

In damask work where only one colour of weft is used, the harness is of course drawn and retained in its lifted position until the required number of picks (from 4 to 12) are given; the cloth being formed by presser leaves, acting upwards on the undrawn warp and downwards (see Fig. 65) on the raised warp, at each pick, till the proper number of picks are thrown in, when the card or lash is changed for another card or lash, and the operation of the headles is again repeated (see also damask weaving, page 468).

In the more elaborate patterns of shawls, vestings and similar goods, where more than one colour of weft is used, it is called "*covered work*," each colour constituting a cover, *if used in the same line*, and all the colours in one line forming *only one pick of actual cloth.* This description of goods is often twice or thrice drawn; but not like the damask; for the colours must be repeated individually, the headle shed being changed *only at a new repetition of the colours.* For once-drawn patterns in full harnesses, where any variety of work may be introduced into the design, such as various kinds of tweeling, flushing, satin, plain, or taffeta, &c.,* but little depends upon the selection of design paper farther than the proportioning of the thicknesses of the warp and weft, which is an easy matter when due attention is paid to the reed-scale; and the number of picks per inch is known, as, for example, an 1,800 harness stands 97 threads per inch:—

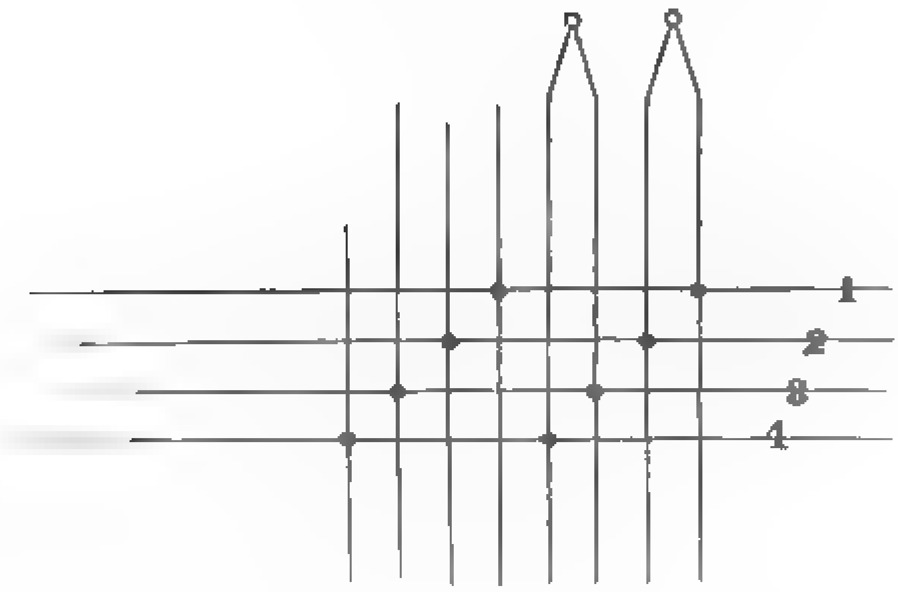
8 by 8	paper	gives	97	picks	per	inch
8 by 9	"	"	109	"	"	"
8 by 10	"	"	121	"	"	"

For split or two-thread harnesses the best description of paper is the French tweeling paper; this paper is calculated for work to be *twice* drawn, and worked with *four* leaves of headles, *one thread being pressed out of each two mails lifted when the weft pick is thrown*, forming, without anything like break or error in the tweel lines, a beautiful *three-and-one tweel* (see Figs. 16 and 17, Section First).

This kind of harness, unlike damask, forms no square or blunt points in the figure, as will be seen by inspecting one of the better description of French shawls; the theory of its action is very simple and beautifully correct.

* The loom represented at Figs. 218 to 229 is of this description.

PRINCIPLE OF THE "TWO THREAD" OR "SPLIT HARNESS."



It will be observed that this harness, though a *two-thread*, and though the same card be *twice* drawn, yet *each pick of weft produces a different effect*, and the correct action of the harness is secured by the use of the tweeling paper; besides which, this paper wonderfully assists the pattern-drawer in accomplishing his work, both in speed of execution and graceful freedom of design; objects which could not be obtained by any other means.

For *four-thread* and damask harnesses the design paper should be chosen of a large scale, as near as possible to the *size of the cloth to be produced*, and the designer should be more guarded in this than any other work against errors, as each will be *magnified* upon the cloth, whereas in fine fabrics they are *diminished*.

For coloured patterns, a rough sketch is commonly drawn out on coarse paper, which, after all the necessary corrections are made, is traced on clean drawing paper, when it is ready for colouring. The method of tracing these sketches is as follows: prepare a sheet of wove writing paper by rubbing it over on one side, first with sweet oil, and afterwards with ground verditure; when it is dry, lay it on the clean drawing paper, and over it the rough sketch. Then with a blunted steel point trace over all the outlines, and a very fine delineation of the pattern will be produced. This done, the different colours are laid on with camel's hair pencils, agreeably to the taste of the manufacturer, or to the style of work to which the patterns are to be applied. It is necessary to observe, however that, as in many kinds of patterns, particularly those intended for low priced goods, the greatest economy is frequently necessary in introducing

the colours, the pattern-drawer's chief study should be to produce as much effect as possible with few colours.

The pigments used by pattern-drawers and designers, are, in general, the same as those which are made up into cakes, and sold in the shops under the name of water colours.

A table showing the various purposes to which the accompanying samples of design-paper may be applied; or otherwise, the various qualities of goods which require these papers, is a thing much needed by many of our manufacturing friends at the present time, and we accordingly submit the following.

DESCRIPTION OF PAPER.	Number of picks per inch once drawn, full or one thread, and on twice drawn, split or two thread harnesses.				Number of picks per inch on twice drawn four thread harnesses.			
	1400 Reed	1600 Reed	1800 Reed	2000 Reed	1400 Reed	1600 Reed	1800 Reed	2000 Reed
8 by 3	28½	32¼	36	40½	14¼	16	18	20¼
8 " 3½	33¼	37½	42½	47¼	16½	18¾	21¼	23½
8 " 4	38	43	48½	54	19	21½	24¼	27
8 " 5	47½	53¼	60½	67½	24	27	30¼	33¾
8 " 6	57	64½	72¾	81	28½	32¼	36	40½
8 " 7	66½	75¼	84¾	94½	33¼	37½	42½	47¼
8 " 8	76	86	97	108	38	43	48½	54
8 " 9	85½	97	109	121½	43	48½	54½	60¾
8 " 10	95	108	121	135	47½	54	60½	67½
8 " 11	104½	118¼	133	148½	52¼	59	66½	74¼
8 " 12	114	129½	145	162	57	65	72½	81
8 " 13	123½	140	157½	175½	62	70	78¾	87¾
8 " 14	133½	151	169½	189	67¼	75½	84½	94½
8 " 16	154	172½	194	216	76	86	97	108
8 " 18	171	194	218	243	85½	97	109	121½
8 " 20	190	215½	242	270	95	107¾	121	135
6 " 6	76	86	97	108	38	43	48½	54
6 " 10	126½	143	161½	180	[illegible]½	71½	[illegible]	90
6 " 20	253	286	323	360	126½	143	161½	[illegible]
16 " 9	42½	48	[illegible]	60¾	21¼	24	27	30¼
12 " 8	50½	57	64	72	25¼	28½	32	36
10 " 10	76	86	97	108	38	43	48½	54
10 " 12	91	103	116	130	45½	52½	58	65

The sample of paper marked A, shows the method of using the tweeling paper. An upright line or warp cord runs zig-zag, embracing two tweel lines; a cross line or weft thread runs straight, and a diagonal line follows the tweel so far as the nature of the figure requires in that direction, and then returns to another tweeling line; the arrangement of the cords is shown in the two squares to the left hand, each diamond shape having two cords laid on it; that is, the card-cutter never cuts less than two holes for each dot in the design paper painted, and one of these is always repeated in the next card or lash, two lines across twice drawn forming once over the tweel.

The principle of chenille paper is, to give the required number of picks or threads of weft to the pattern by measurement, the paper being cut into slips, each representing a stripe of the pattern, making allowance for the amount of twist to be given to the weft after being cut out of the loom and previous to its being re-woven or *set*, as it is called. See chenille, page 259; and see also description of Whytock's carpet, page 232.

Paper for hearth-rugs and oil-cloth should be as large as the pattern is intended to be on the goods when finished.

In making the foregoing table we have been as concise as possible, bearing in mind that a work of this description is neither fitted for amusement, nor intended to beguile the *ennui* of a tedious hour, but solely for facilitating the operations of the manufacturer and for the dispatch of business.

FRENCH CARD-CUTTING MACHINE.

In order to lay before our readers the most perfect method of cutting cards hitherto discovered, we made drawings while in France, of this splendid card-cutting machine (to which we alluded at page 209); and we trust that from the following description and the accompanying plates, which have all been very carefully executed, the whole will be clearly understood.

The card-cutting machine, with Jacquard attached, is shown in Figs. 241, 242 and 243.

Fig. 241, represents a side elevation of the machine, and front of the Jacquard.

Fig. 242, a front elevation of the machine (on an enlarged scale) showing a full view of the pulley-box, through the Jacquard.

Fig. 243, sections of the machine and Jacquard, with pulley-box, needles, springs, punches, weights, &c., one side of the framing being removed, to show the whole arrangement.

Fig. 244, back upright section, showing the simple or reading-on cords.

Fig. 245, side view, in section of the same. This may be either a separate frame, called the "lashing frame," or the lashing may be done on the simple attached to the cutting machine, without removing the simple.

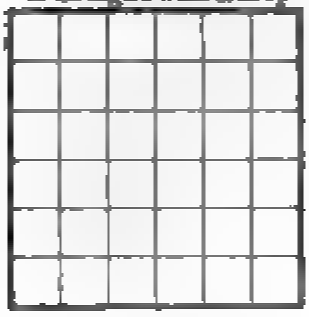
Figs. 246 and 247, front and side elevations of an ordinary fly-press, with a three-thread screw, and a lead follower or platen, extending the full length of the card to be cut.

The same letters refer to similar parts in all the Figs.

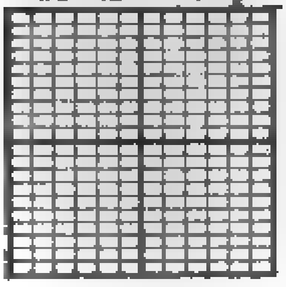
It will not be necessary to explain the arrangement and operation of the Jacquard, as that has been done elsewhere (see page 192); besides, it is only an auxiliary to the machine under consideration.

A, is a case or frame containing a series of needles, similar to those used in the Jacquard machine; B, C, D, (Fig. 243) three thin brass perforated plates, corresponding to the front needle-board and

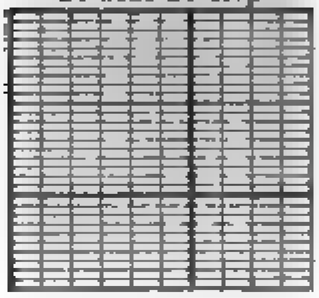
6 by 6 N°1.
11 designs wide 11 deep



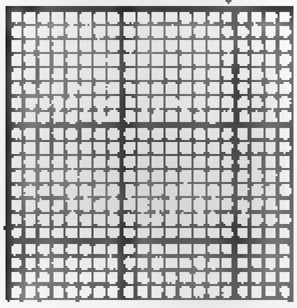
6 by 10.
38 wide 30 deep



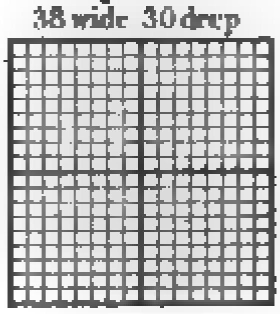
6 by 20.
29 wide 23 deep



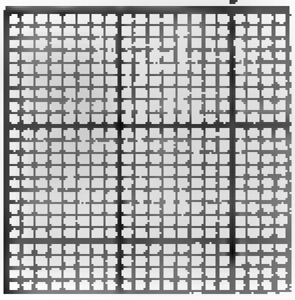
8 by 8 N° 5.
40 wide 49 deep



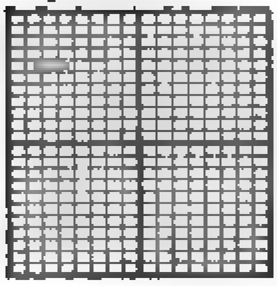
8 by 9 N°1
38 wide 30 deep



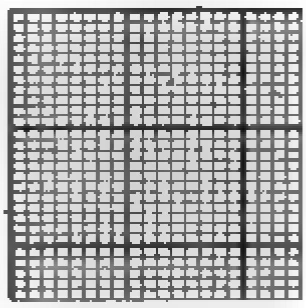
8 by 9 N°2
40 wide 40 deep



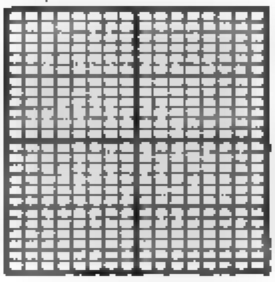
8 by 11 N°1.
38 30



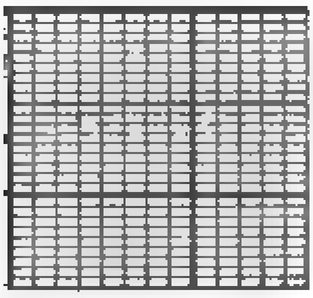
8 by 11 N°2
40 50



8 by 12 N°1.
38 30



8 by 18
20 14



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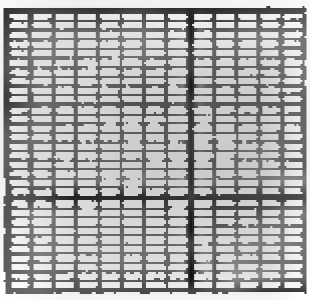
20 14



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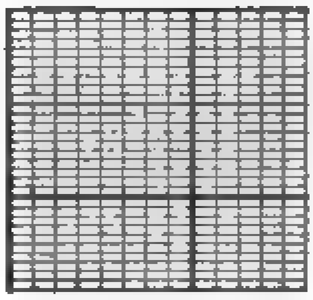
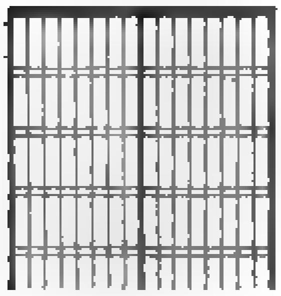
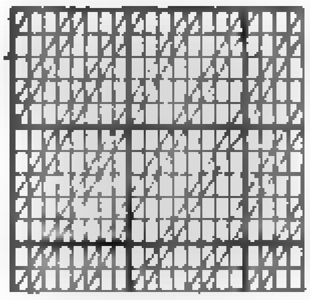
38 23



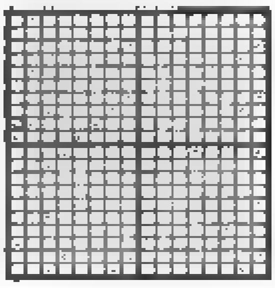
Chenille N°1.



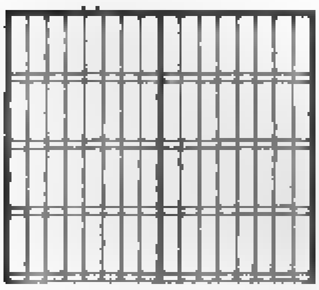
8 by 5 N°1.
40 40



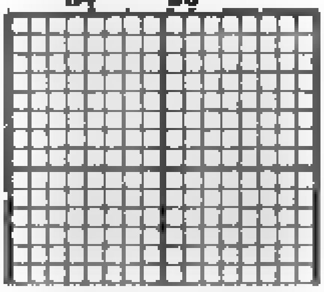
8 by 10 N°7
38 30



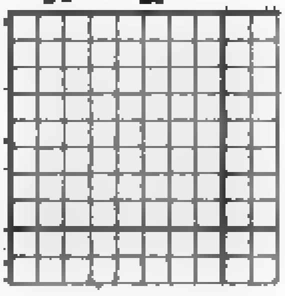
Chenille N°3.



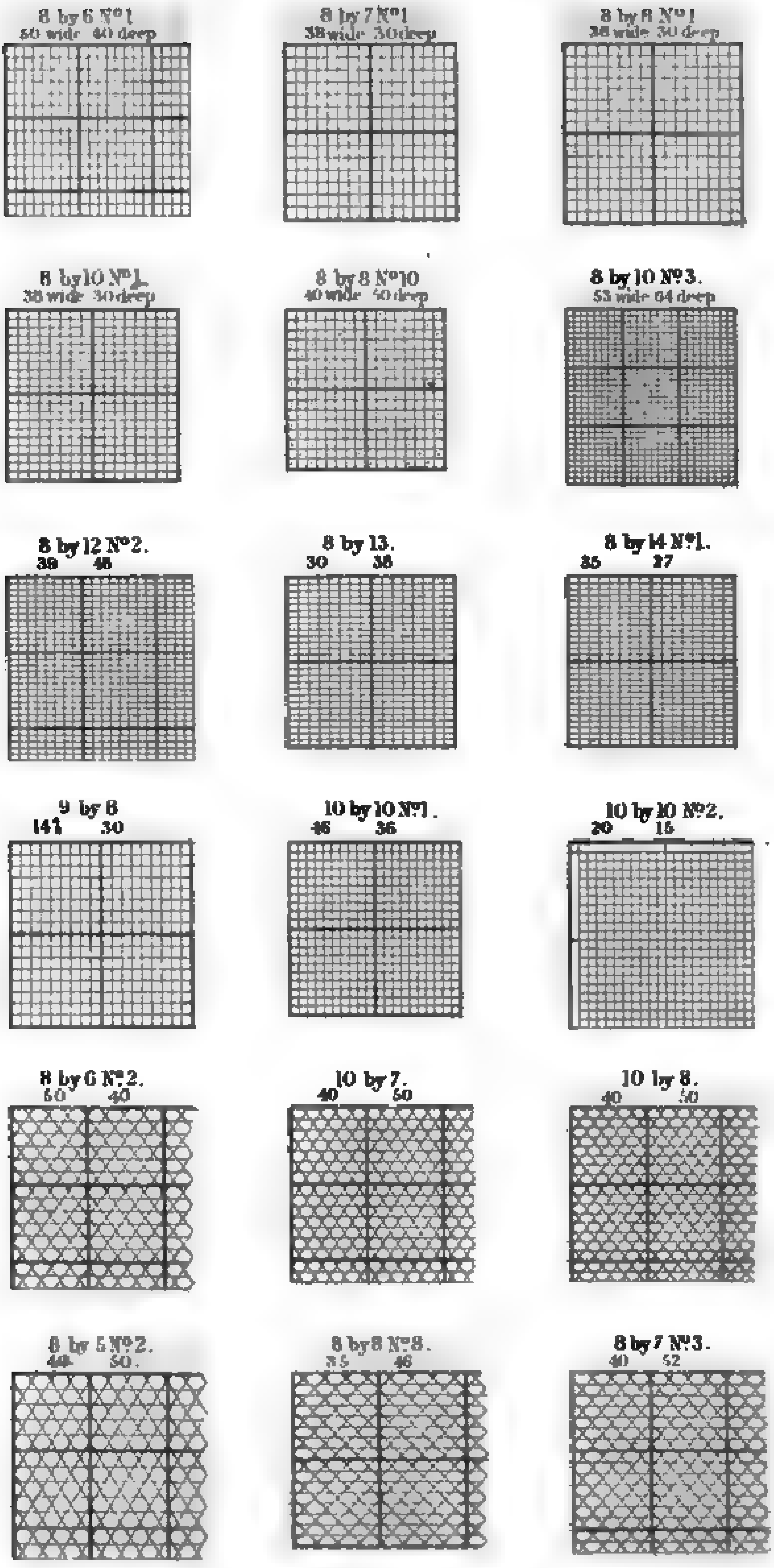
8 by 8 N°6.
34 26

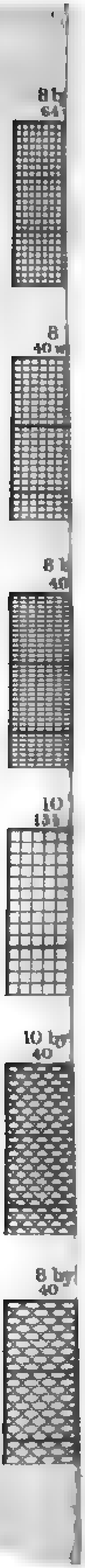


8 by 8 N°7.
26 21

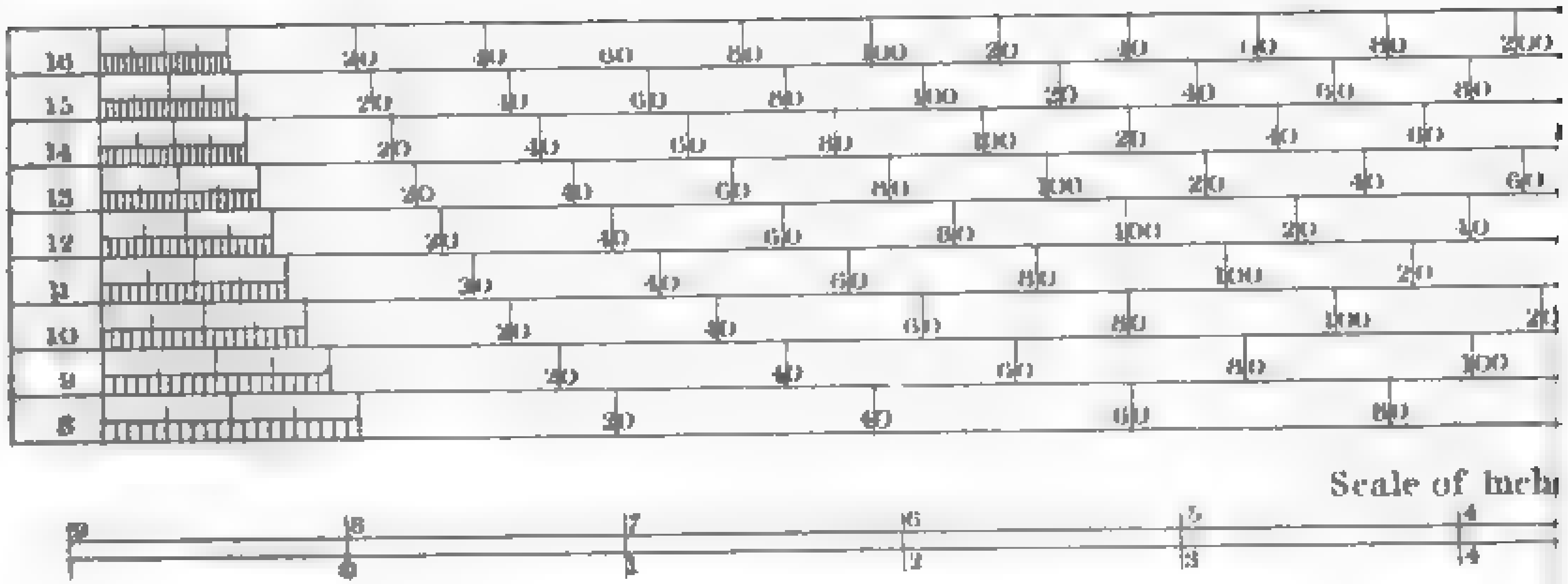


SAMPLES OF DESIGN PAPER





REED SCA



cylinder of the Jacquard; E, (Figs. 241 and 243) a thick brass or cast iron plate, full the thickness of the length of the punches, fixed close to the cutting plate G, the cutting plate in its position, with the *form* or stud plate H, closed down and the punches forced into the brass plate E; H, the stud plate (made generally of wood), with small wire studs driven or screwed into it, and corresponding to the scale of the needle board; this stud plate has a board F, screwed to it, to prevent the studs or pins, which drive home the punches, being forced back; I, the folding joint to which the stud plate H, is attached, for the purpose of being easily thrown up when the operative is about to remove the cutting plate G; J, (Fig. 243) brass spiral springs, operating between the centre plate C, and a barb upon the needles, round which they are coiled, and forcing the needles toward the front; K, balance weights, rather more than sufficient to keep the springs J, (Fig. 243) from acting on the needles, to which the weights are attached by cords; L, and M, guide or hole boards, through which the cords pass, dividing at M, into two, for the purpose of keeping the leads clear and from twisting or entangling one another; N, (Fig. 243) twelve smooth glass rods or rollers, corresponding to each row or line of holes to be punched; O, (Figs. 241 and 243) cords connecting the punch needles with the reading-on simple; P, cords connecting the Jacquard with the punch needles; Q, a continuation of the cords O, and P, both being attached above the hole board M, and either acting as it may be required upon the weights K, thereby allowing the springs J, to force the needles outward, and, consequently, the loose punches that may be necessary for the particular card from the plate E, into the cutting plate G; when this is done, the stud plate H, is thrown up on its joint, thereby allowing the punches free access into the plate G; R, the reading-on cords or simple, on which the pattern is lashed or read; it is attached to a roller S, at the bottom of the machine; this roller works in two brackets, and has a ratchet T, and click U, whereby the simple can be tightened as the pattern comes to an end, the removing of the lashing or reading threads slackening the simple gradually as they are taken off. The attachment of the simple to double cords at the harness board V, is to prevent the cords losing any of their twist and thereby becoming unequal in length in the course of the working; W, a series of wire hooks for conveniently attaching the simple after coming from the reading frame—a number of readers or lashers being employed for one machine, each having a simple made to suit and ready to be attached as soon as the lashing upon the simple in operation is exhausted; X, double cords

attached to the upper part of the hooks W, to prevent the hooks turning round, and connected over the pulley-box Y, to counterpoise weights F'; Y, the ordinary draw-loom pulley-box, containing 624 small pulleys, or any number, of course, according to the size of the Jacquard.

After removing the simple from the lashing frame (Figs. 244 and 245) and attaching it to the hooks W, the train of operations is as follows:—The draw-boy seizes the lash Z, (Fig. 244) which separates the required quantity of cords from the others, and he either pulls those with his hand or a rod for the purpose, thrusting it into the shed made by the lash Z, and pulling it forward; the cords pulled glide over the pulleys of the box Y, the glass rods A', and N, (Fig. 243) raise the weights K, in the direction of the arrows, thereby relieving the springs J, which force the punches forward into the cutting plate G. The operative now seizes the plate by the handles in front, dexterously turns it on its flat, and carries it with its necessary number of punches to the fly-press (Fig. 246.)

The press-boy has a blank card ready placed upon a sole plate, with the usual steady pins or guides fitting exactly to slots or holes in the plate G, which with the punches the workman places above the sole plate, shoves both under the press platen or lead follower, the boy gives a half turn of the press-arms above, and the card is perforated. Should more than one set of cards of the same pattern be wanted, the press operation is repeated according to the required number: or, when the paper is light, two cards may be cut together. The workman now seizes his plate, thrusts it into its place in front of the plate E, closes down the stud plate H, which he raises, while the draw-boy pulls the simple so as again to force out the required number of punches, and so on till the pattern is completed.

The punches are prevented from falling through the plate G, by a small ruff or collar, turned upon the inner end of them.

The Jacquard operates similarly to the simple, being also attached to the weights K, the springs J, and cords P; the draw-boy working the Jacquard instead of the lashes; it is used to advantage in renewing a pattern, or in making duplicates after testing the merits of a design upon cloth.

Fig. 244, represents the lashing-frame; V, the hole-board (same as in Figs. 241 and 243), which is removed along with the simple into the machine and secured by bolts, seen in Fig. 241; B', springs for giving elasticity to the simple-cords in the operation of lashing.

The lasher reads over the design C', (missing those cords not re-

quired,) between the round rods D', and E',* and if there be *more colours than one*, as in covered-work, such as shawls, he reads on a separate lash for each colour, which lashes are generally all attached to what is called a *bridle*, (see lashing for draw-loom, page 157) forming one line across the design or pattern; such as red, blue, green, yellow, white and black, which would constitute work of six covers, unless the ground (say black) was repeated twice, when it would be seven covers; and seven lashes would be necessary to complete one pick or shot of cloth.

The lasher after completing one line (if for damask, only one lash is required) proceeds with the next, until he has the whole pattern read or registered on the simple, when it is ready to be removed to the cutting machine.

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* It is customary in England and Scotland for lashers to use a reed, corresponding in fineness to the design paper, and into this reed they pass all the simple cords. (See reading or lashing, page 157, and Fig. 70.) In France, however, the reed is not used, rods like those represented at D', and E', (Figs. 244 and 245) being preferred, and the simple cords are passed under and over each of them alternately, forming a lease. The operator works over the cords between the rods with her right hand, commencing at the left side (females only are employed in this operation in France), and taking those cords which are indicated by the design placed above. As soon as the line of pattern has been gone over, she draws the cords thus selected towards her, with her left hand, immediately below the rod E', and nstantly inserts the lashing twine, and so on for each successive lash, until the pattern is completed.

TESTIMONIALS.

In order to lay before the public the opinions of some of the most eminent French, English, and other manufacturers, regarding the merits of our patent power looms, we subjoin several Testimonials, which have been received by us on the subject. We have not translated the French documents, preferring to give them exactly as received from the several parties; and, besides, it saves room: any person however, who does not understand the language, but who may feel anxious to ascertain what these documents contain, need be at no loss for a translator. The English Testimonials will, perhaps, be sufficient to satisfy most people, without any additional proof.

COPIE.

Je soussigné P. A. Pihet, constructeur Mécanicien, demeurant à Paris, avenue Parmentier, No. 3, déclare que j'ai connu M. C. G. Gilroy natif de la Grande Bretagne vers le mois de Décembre 1834, et que j'ai passé contrat avec le dit Sr. C. G. Gilroy pour la construction d'un nouveau métier de son invention et pour lequel des brevets ont été pris en France par M. Pihet pour cette même invention, qui consiste en un moyen mécanique par lequel la machine appellée Jacquart marche par un moteur quelconque, et qui permet de *supprimer entièrement les moyens à la main employés jusqu'à ce jour pour obtenir les mêmes résultats.* Le dit Sr. C. G. Gilroy ayant mis à exécution le dit métier dans mes ateliers, depuis la date ci-dessus exprimée jusqu'à ce jour a demandé et obtenu des patentes ou brevets pour l'Angleterre, l'Ecosse et l'Irlande, où il désire propager sa découverte. En conséquence, je déclare donc, dans l'intérêt de la vérité, que le métier de l'invention de M. C. G. Gilroy, et qu'il a construit chez moi, pour faire marcher sans aucun aide le mécanique Jacquart ainsi nommé, a été établi sous *tous les rapports à mon entière satisfaction, et qu'il produit des étoffes parfaites, sans etre plus sujet à se déranger qu'un simple métier mécanique pour calicot*, et qu'enfin, *toutes les étoffes façonnées et autres peuvent y etre fabriquées en changeant seulement les cartons et sans toucher* au *mécanisme.* Le métier marche à raison de 100 et même 115 coups de la navette à la minute, soit pour faire une étoffe forte ou légère, et d'excellente fabrication.

Fig. 241.

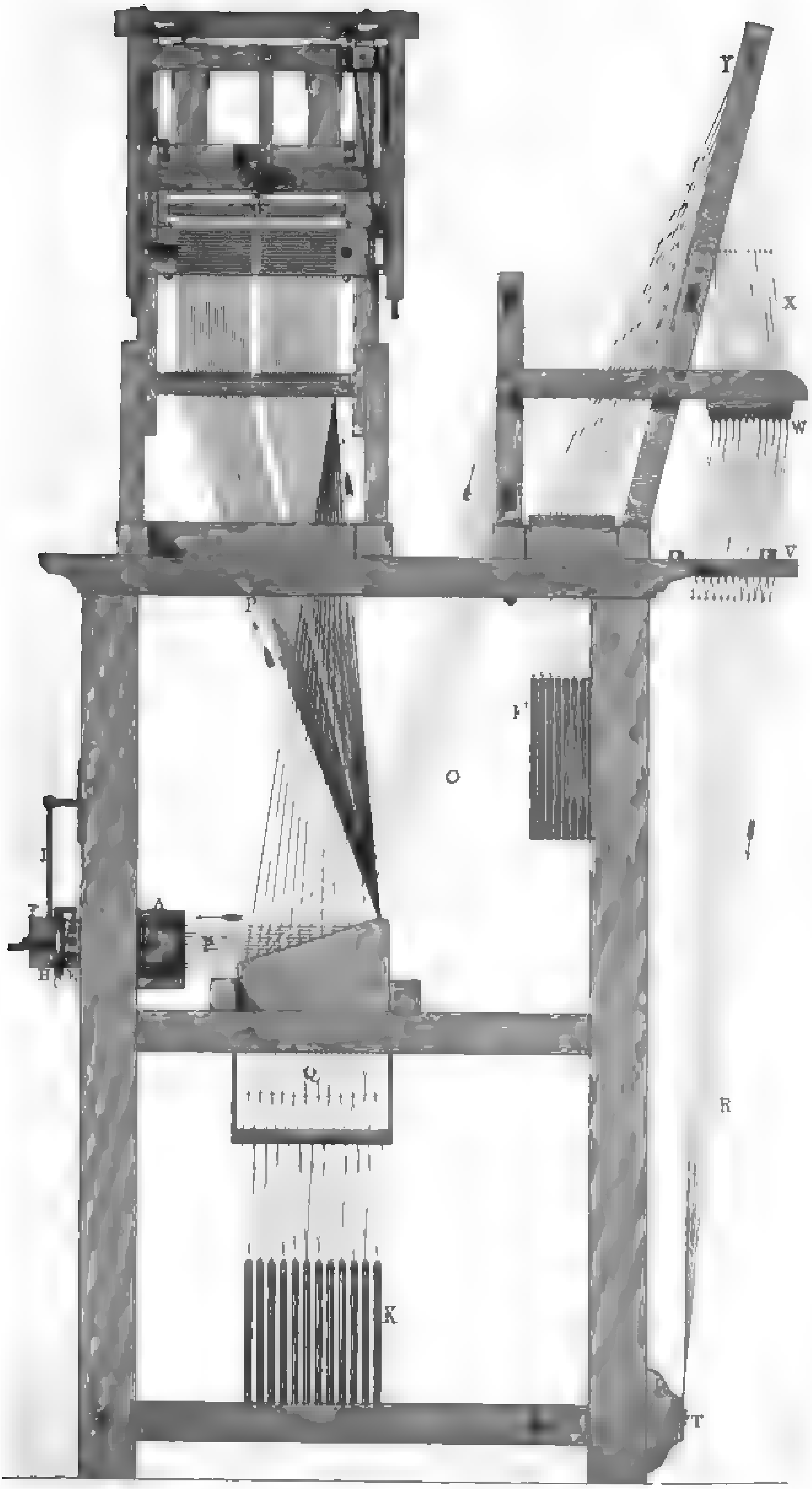


Fig. 242.

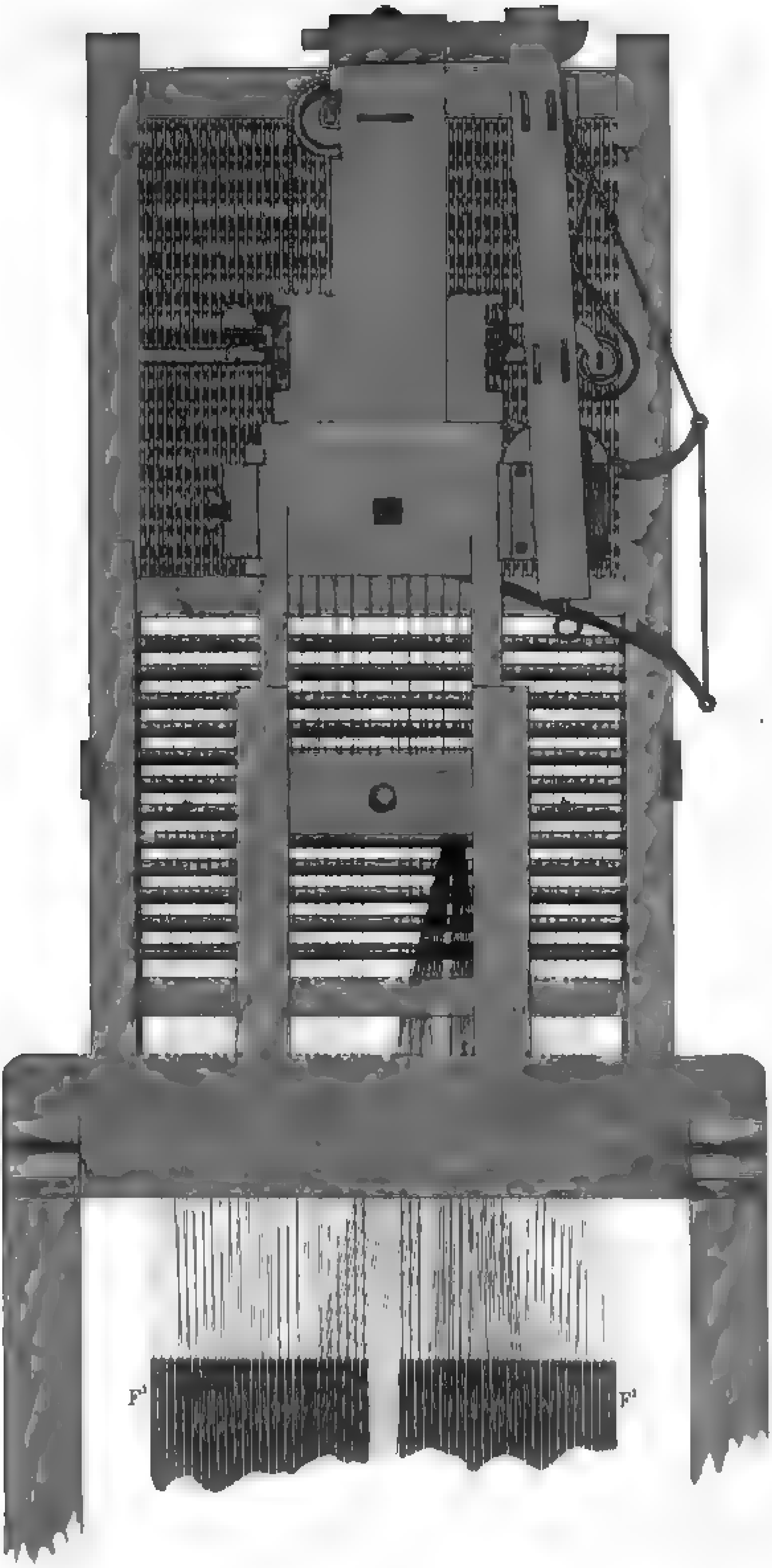


Fig 242

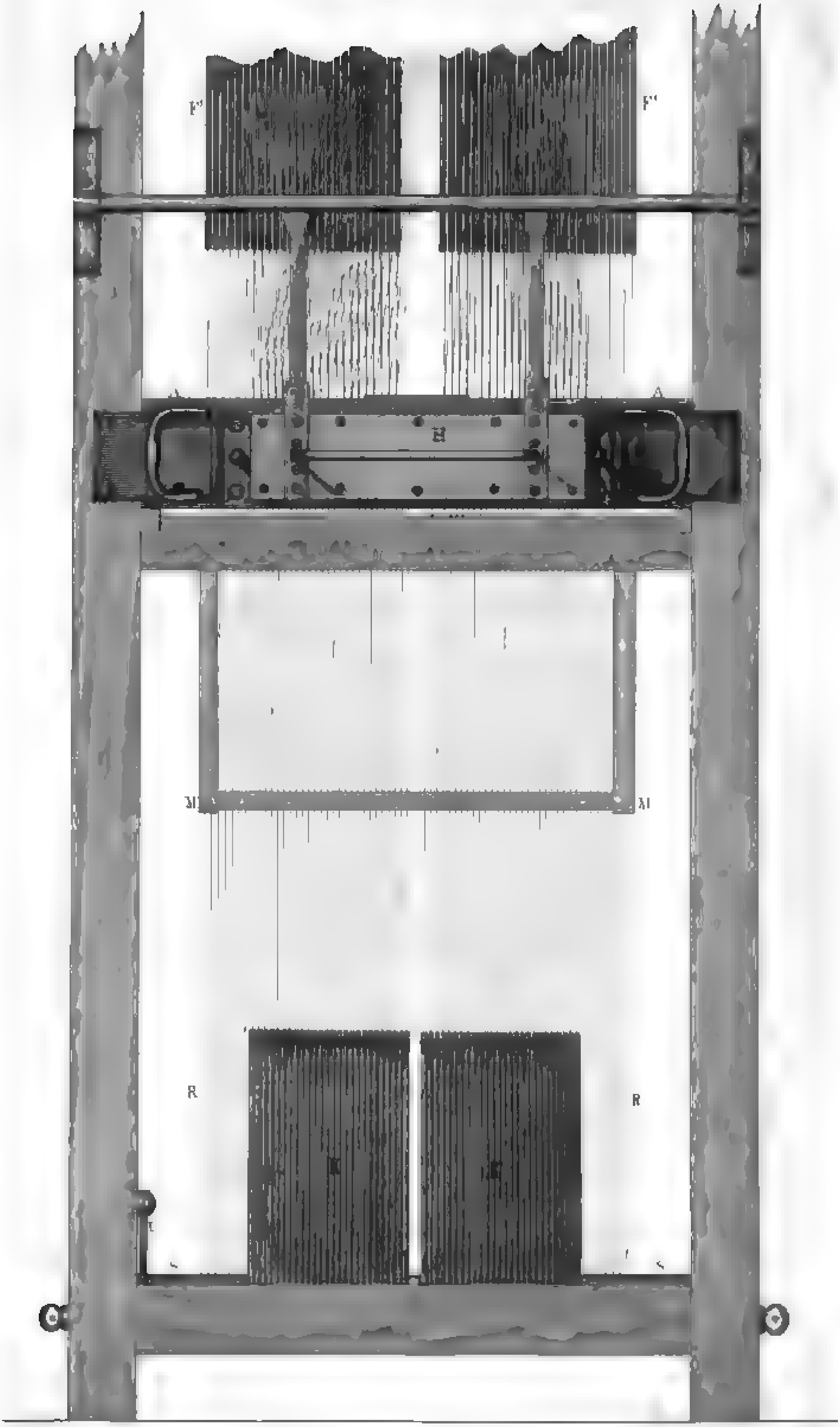


Fig. 243

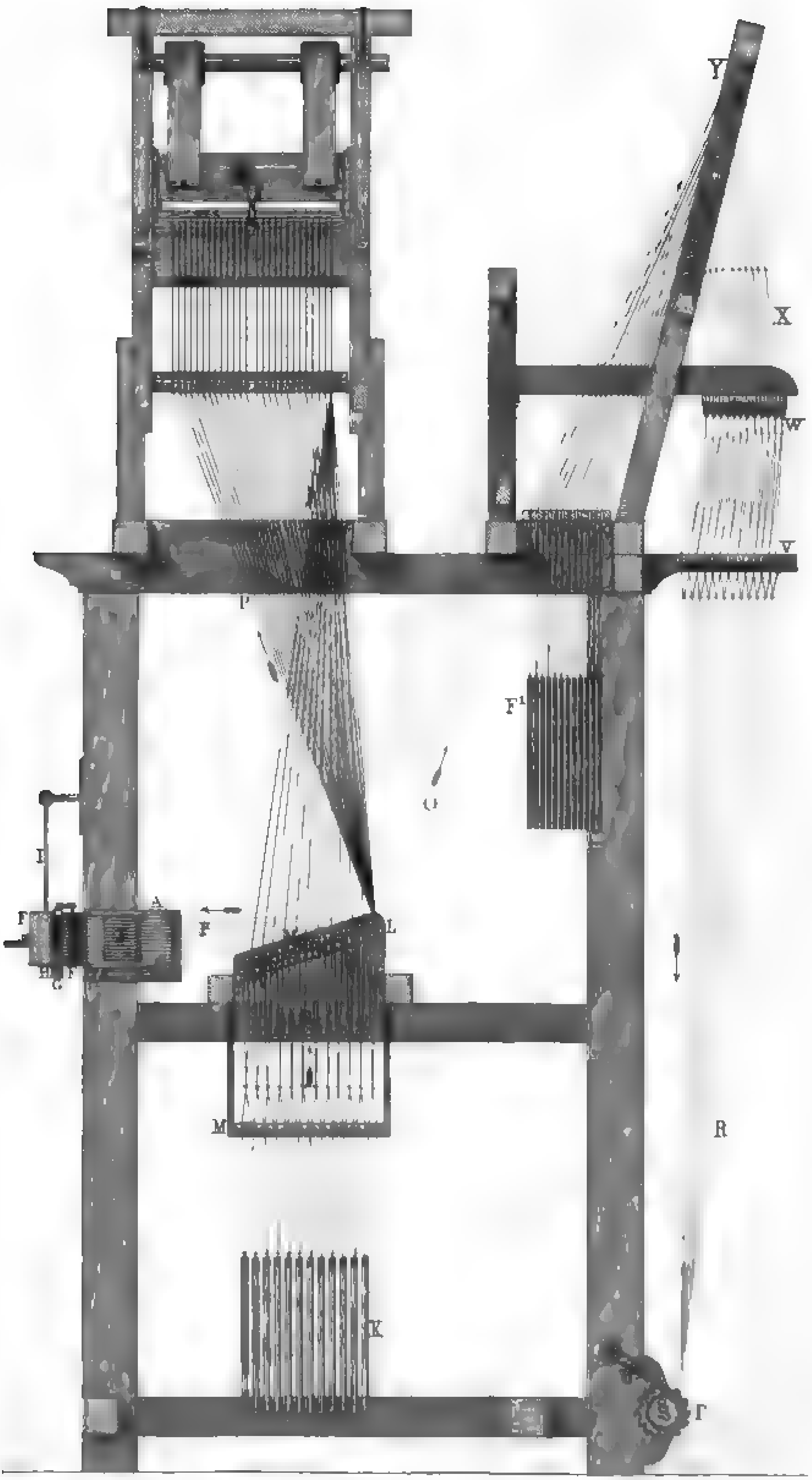


Fig 244.

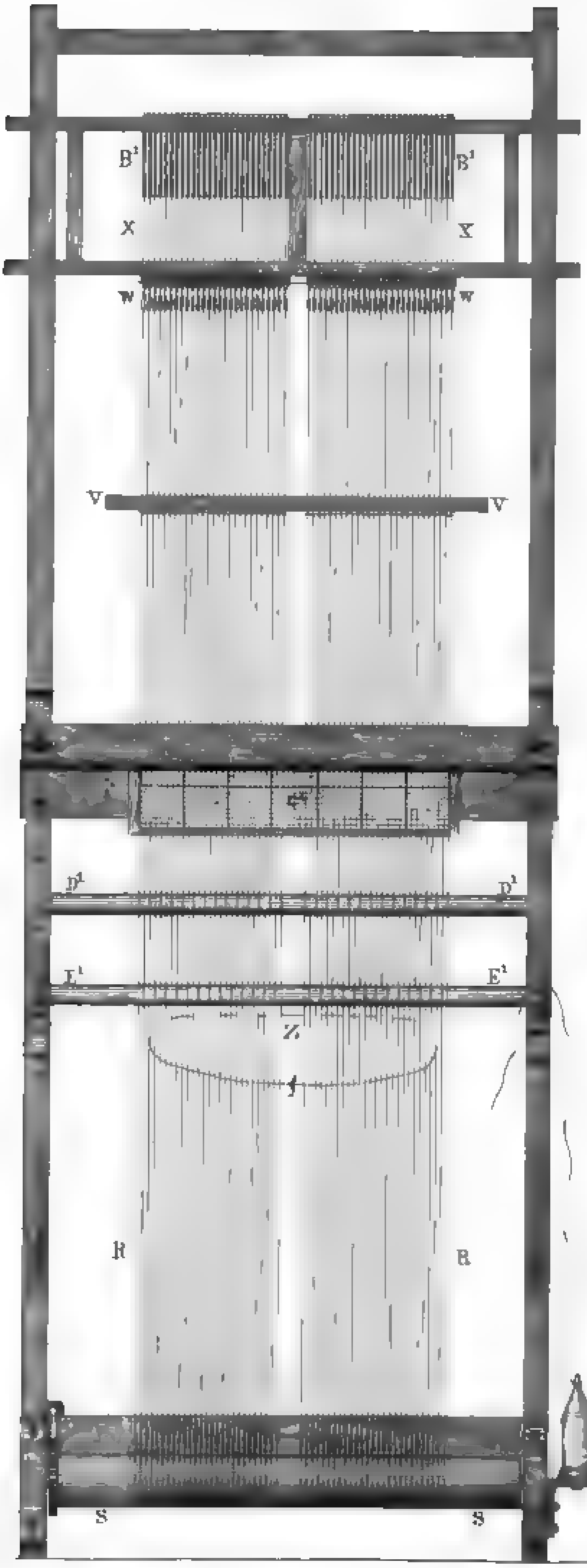


Fig 245.

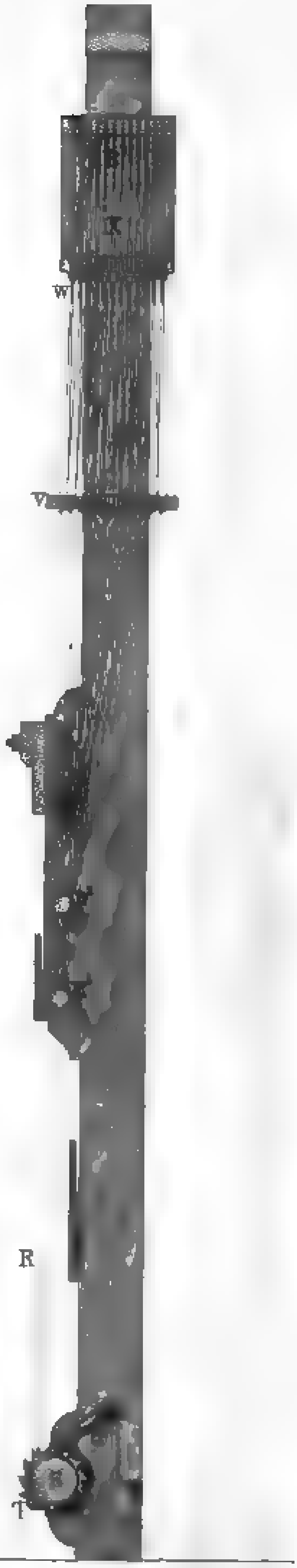


Fig.247

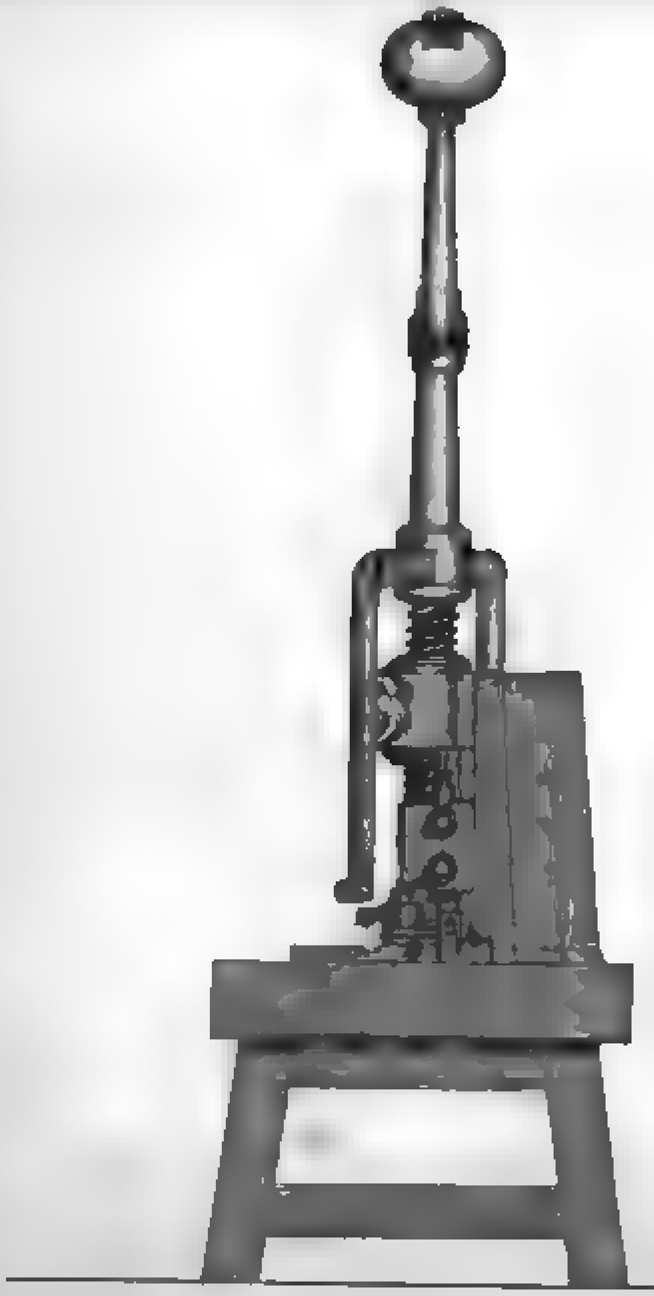
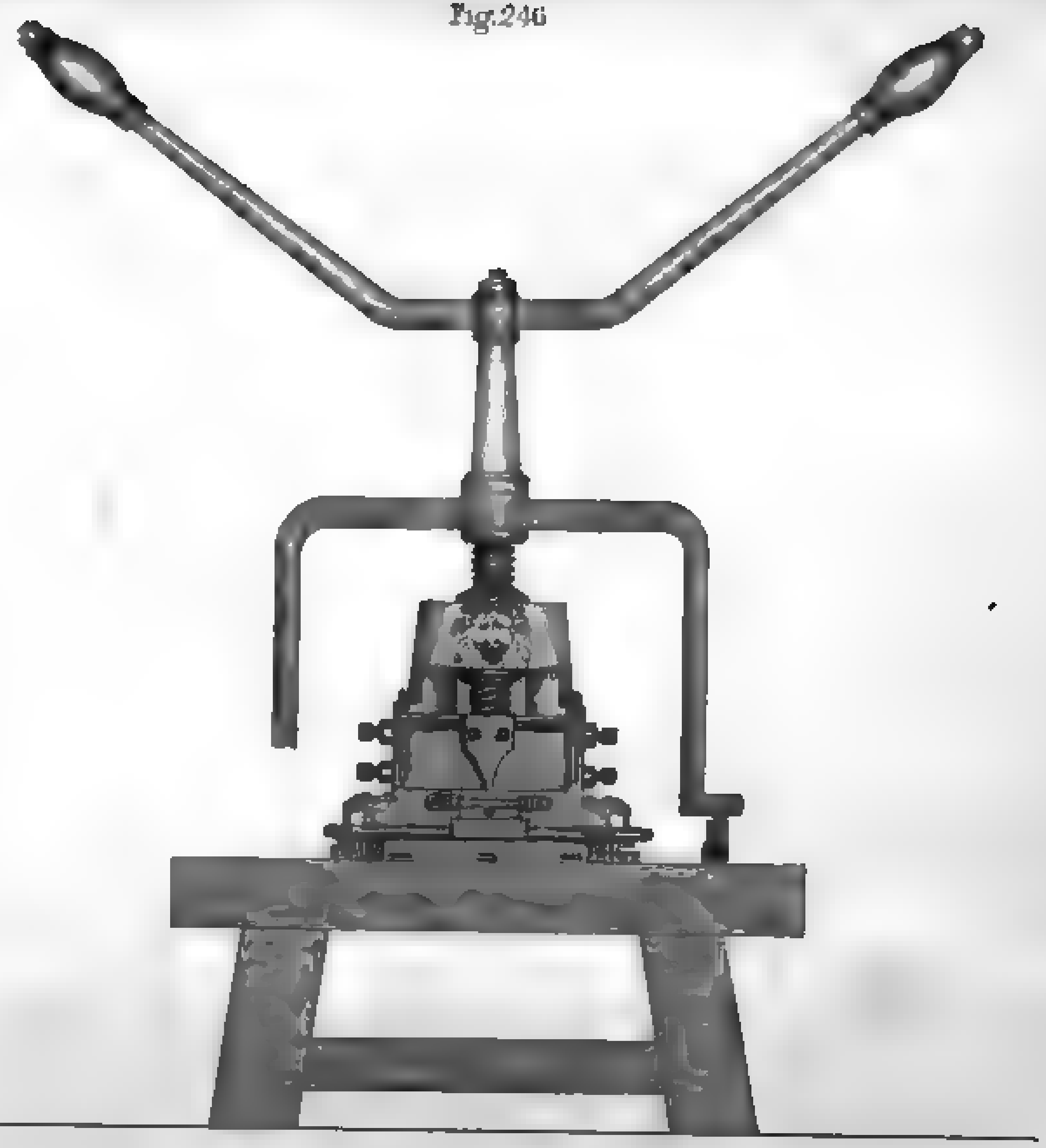


Fig.246



Je déclare également que je considère M. C. G. Gilroy comme un homme très industrieux et d'une grande persévérance ; qu'il est *très capable de mener à fin ce qu'il promet au sujet de ses perfectionnemens et inventions concernant les métiers à tisser.*

En foi de quoi je lui ai délivré la présente attestation pour lui servir en tant que de besoin.

Fait à Paris le quatre Mars 1838.
Approuvé l'écriture
Signé—P. Aug. Pihet.

Nous soussignés, ayant vu en pleine activité de travail dans les ateliers de M. Pihet, constructeur mécanicien à Paris, le nouveau métier Jacquart, mécanique de l'invention de M. C. G. Gilroy, métier d'ailleurs mentionné dans l'attestation ci-contre, déclarons et attestons que le dit métier marche avec toute la perfection désirable et que, non seulement il donne beaucoup plus en produit que les métiers à la main, mais que ces mêmes produits sont *supérieurs* en régularité et en perfection.

Nous déclarons en outre qu'une jeune fille peut aisément gouverner trois de ces métiers.

Fait à Paris le 5 Mars 1838.
Signé.—Dioudonnat,
Constructeur de Mécaniques Jacquart.

Vu par Nous, Maire du 8e Arrondissement de Paris pour légalisation de la signature de MM. P. A. Pihet ci-contre et Dioudonnat, apposée d'autre part.

Paris, le dix Mars 1838.

Le Maire (L. S.) Signé.—Baytet.

Je soussigné déclare avoir vu fonctionner le métier dont il est question dans le présent certificat, mon opinion est qu'il remplit le but que l'auteur s'est proposé, et qu'il doit satisfaire à toutes les exigences du tissage en général.

Signé.—Henry, Aîné.

Nous partageons l'opinion ci-dessus énoncée par Monsieur Henry.
Signé—Couchot Rey Lebeuf Lehr.

Je soussigné déclare que le métier à tisser dont il est parlé ci-dessus me paraît pouvoir parfaitement remplir le but que s'est proposé son auteur.

Signé.—A. Dhomme.

Vu par le Maire du 3e Arrondissement de Paris pour légalisation de la signature de MM. Henry aîné,

Paris, le 13 Décembre 1840.

Signé.—Decan. (L. S.)

Vu par le Maire du 5e Arrondissement de Paris pour légalisation de la signature de M. Dioudonnat.

Paris, le 13 Décembre 1840.

(L. S.) Signé. Foccard.

Je soussigné traducteur assermenté, certifie que la copie qui précède est conforme à l'original et que foi doit y être ajoutiée tant en jugement que hors.

Paris, le 13 Décembre 1840.

(L. S.) F. Gardera.

Vu par le Maire du 3e Arrondissement de Paris pour légalisation de la signature de M. Gardera, traducteur assermenté.

Paris, le 13 Décembre 1840.

Periort Troursscay. (L. S.)

Je soussigné certifie avec plaisir que les métiers a tisser les étoffes faconnée ou unie pour la soierie et le lin que j'ai construit pour M. Charles Cunningham sous la direction de M. C. G. Gilroy ont parfaitement rempli le but qu'il s'était proposé.

1o Pour l'enroulement de l'étoffe de manière à ce que la trame dans le commencement de la pièce ne soit pas plus serrée qu'à la fin. Par ce moyen l'on met autant de fil de trame qu'on désire par centimêtre.

2o Pour que le fil de trame se trouvant tendu et dans une position parrallèle à l'étoffe évite tous les bouclages.

3o Pour le mécanisme nécessaire à faire marcher la Jacquart qui est tellement doux qu'il permet de donner a ces métiers la *vitesse* des métiers à calicots.

4o Pour le mouvement nécessaire à arrêter le marche du métier quand le fil de trame vient à casser; et enfin j'affirme que *tous les fabricants que j'ai vu venir dans mes ateliers pour visiter ces métiers ont été d'accord sur les avantages et la simplicité de ce système*

En foi de quoi j'ai signé le présent pour rendre hommage a la vérité.

Paris le 21 Décembre 1840.

E. Phillippe.

Ing. mécanicien rue du Chateau Landon, No. 19, à Paris.

J'ai visité à plusieurs reprises, des métiers très bien montés et parfaitement organisés, garnir de leur piéce, pour travailler avec la mecanique Jacquart. Ces métiers appartiennent à M. Charles Cunningham, et sont construits par M. C. G. Gilroy dans l'établissement situé No. 19, rue château Landon, faubourg St. Martin.

Les avantages que j'ai appréciés sont:

1o L'application de le mécanique Jacquart, mu regulierement et agis-

sant aussi activement par un moteur, que tel métier à tisser le calicot, la soie, la toile, mu avec la plus grande vitesse.

2° Le mécanisme pour que la duite lancée, passe et se cage sans bouclage.

3° Le mécanisme qui forme de belles lizières.

4° Le mécanisme pour être certain et assuré qui vient à casser, arrête immédiatement la navette et la mécanique Jacquart.

5° L'enroulement de l'étoffe s'exécutant independamment de sa reduction.

6° Le mode de donner à toute étoffe faconnée, ou unie le dégré de reduction à volonté.

Paris, le 18 Décembre 1840.

BOSQUILLON.

Fabricant de châles et étoffes nouveaus, No. 13, rue neuve St. Eustache.

Vu par le Maire du 3e Arrondissement pour légalisation des signatures de MM. BOSQUILLON, HENRY, aîné, et LEHR.

Paris, ce 24 Décembre 1840.

(L. S.) DECAN.

J'ai vu et j'ai examiné de près les métiers mécaniques brevetés, de M. Charles Cunningham construit par M. C. G. Gilroy. Je les trouve parfait tant pour leur montage que pour leur produits.

Paris, le 18 Décembre 1840.

DIOUDONNAT.

Rue St. Maur, No. 12.

J'ai vu marcher les métiers de M. Gilroy ; ils m'ont paru réunir tous les avantages mentionnés ci-dessus.

Paris, 20 Décembre 1840.

LEHR.

12 faubourg Poissonière, maison Couchot Rey Lebeuf Lehr, passage des Petites Ecuries No. 12.

J'ai vu les métiers ; j'ai examiné l'exactitude et l'assureté de la manœuvre, les produits qu'en résultent me paraissent ne rien laisser à désirer.

Paris, le 19 Décembre 1840.

HENRY, Aîné.

Fabricant, 13 rue Poissonière.

Nous soussignés certifions que nous avons vu fonctionner le métier à tisser mécanique de M. C. G. Gilroy ; nous considérons cette invention comme ingénieuse et pouvant donner d'heureux resultats sur tout pour les étoffes de soie.

H. DEBERGUE & SPREAFICO.

Ingénieurs, 228 Quai de Jemmappes, Paris.

Vu à la Mairie de 5e Arrondissement pour légalisation de la signature Sr. Debergue & Spreafico, apposée à dessus.

Paris, le 23 Mars, 1841.

Le Maire du 5e Arrondissement de Paris.

(L. S.) Foccard.

Nous, soussignés, certifions que pendant huit années, jusqu'à ce jour, nous avons vu et suivi, les diverses inventions et perfectionnements que le Sr. Clinton G. Gilroy a fait dans son mécanisme, pour arriver à une amélioration complète, qu'il a maintenant obtenue, et que nous manufacturiers nous avons justement appreciés. Le tems et les vielles qu'il y a consacrés, sans énumérer les énormes dépenses qu'il a faites; ont été couronnés d'une réussite complete pour ce qui est du mécanisme.

1o La machine dite Jacquard, quoique fonctionnant avec rapidité, et marchant à 110, 115, et même 125 coups de navettes à la minute, n'a aucune secousse dans ses mouvemens, elle a la douceur qu'exige la fabrication des tissus de Soirie.

2o L'ingenieuse idée d' arreter le métier au premier fil de trame qui se rompt, ou à chaque canette finie, était indispensable pour la perfection de l'étoffe.

3o La manière d'enrouler l'étoffe donne la facilité de donner, autant qu'on le désire, de coups de navettes par centimètre; c'est à dire la réduction voulue pour tel genre d'étoffe, laquelle que ce soit, et avec une régularité exacte, depuis le commencement de la chaîne jusqu'à sa fin.

4o Il restait encore un obstacle, à vaincre, le Sr. Gilroy a parfaitement su le surmonter: C'était d'éviter le rebouclage de la trame, fait sur le lisière, produit par le diagonal que fait le fil de trame par le mouvement du battant. Il fallait pour éviter cela, un moyen sûr; il a reussit parfaitement, et on peut dire que son idée est aussi simple qu'ingenieuse.

5o Il fallait empêcher les cartons de s'echapper du cilindre, ce cas arrivant quelquesfois par la vitesse de la marche du métier, et faisait faire des défauts à l'étoffe, et occasionnait la perte d'un dessin (*les cartons*) forte couteux. Ce désagrément est parfaitement évité.

6o Pour faire éxecuter un grand dessin, on ne pouvait le faire sans le concours des lisses devant le corps, ce qui devenait dispendieux par le grand entretient qu l'exige une remise, et augmentait en complication le montage des métiers. Par son procedé, il est parvenu à faire éxecuter les dessins de la plus grande dimension, sans l'emploi des lisses, ce qui en simplifiant le métier devient un grand avantage pour l'ouvrier.

7o Il fait marcher tour à tour, par son mécanisme, plusieurs navettes pour les dessins à plusieurs couleurs, etc.

Nous nous résumons en disant que le métier a tisser-mécanique, à la Jacquard, de l'invention du Sr. Clinton G. Gilroy, est celui qui offre le plus de perfection pour la fabrication de les differentes étoffes de soie et autres dans les articles les plus délicats par leur éxécution, et qu'il a fabriqué à Paris en sont la preuve.

William Webb, 26 Wood St., Spitalfields, London.
H. Sanford & Varrel. Avenue Tradaine No. 1, 2e Arrondissement.
E. Fontaine. 87 rue Hauteville, Paris.
Lehr. 12 faubourg, Poissonnière.
Henry, Aîné. 13 rue Poisonnière.
Boucher. 6 rue des fossés montmartre, Paris.
Andelle. 5 rue Hauteville, Paris.
C. Depuille. No 22 rue neuve St. Augustin.
A. Soulas. 5 rue Hauteville, Paris.
Dioudonnat. 12 rue St. Maur.
Raffard. 372 rue St. Denis.
Bosquillon. No. 13 rue neuve St. Eustache.
E. Phillippe. Ing. mécanicien, rue Château Landon, No. 19. Ayant construit les métiers relatés ci-dessus.
Eugene Vasserot. Ing. mécanicien, 19 rue Château Landon.
Cerisiaux & Co. Ing. mécanicien.
Robert Middleton. Engineer, rue Rochechouart, Paris.
Placide Caille. 94 rue St. Maur, Popincourt.
E. N. Robert.
William Sudds. Rouen.
J. Frood. Ingénieur.

Vu par nous, Maire du 6e Arrondissement de Paris, pour légalisation de la Signature du Sr. Raffard, apposée au bas du présent.
Paris, 24 Mars 1841.

(L. S.) Ch. Grondar.

Vu pour la attestation des signatures Phillippe et Vasserot.
Paris, le 23 Mars 1841.
Le Commissaire de Police du Quartier du faubourg St. Denis.

(L. S.) Baifitte Grégeart.

Vu par le Maire du 3e Arrondissement pour légalisation des signatures de MM. Henry, Lehr, Bosquillon, Andelle & Soulas et Fontaine.
Paris, ce 20 Mars 1841.

(L. S.) Decan.

Vu pour attestation de la signature de MM. Sanford & Varrall, apposée ci-dessus.

Paris, le 22 Mars 1841.

Le commissaire de Police, Quartier faubourg Montmartre.

(L. S.) Atour.

Vu à la Mairie du 8e Arrondissement de Paris légalisation de la signature de M. Dioudonnat, traînée au milieu de cette feuille.

Le 24 Mars 1841.

(L. S.) Le Maire. E. Gue.

Je soussigné certifie avoir vu fonctionner la machine de M. Gilroy à manière à ne laisser rien à désirer comme success.

A. H. Neville.
Ingénieur, 19 Passage Saulnier.

J'ai vu marcher le métier mécanique Jacquart de M. Gilroy, et en ai été fort satisfait sous tous les rapports.

Essonne (Seine-et-Oise.)

E. Feray.

Vu à la mairie d'Essonne pour légalisation de la signature de E. Feray apposée au bas du présent.

Essonne, le 25 Mars 1841.

(L. S.)

Je soussigné m'empresse de reconnaître que le Sr. Gilroy a certainement obtenu les resultats les plus parfaits que l'art mécanique puisse jusqu'à ce jour apporter au tissage.

Felix. Cordir.
42 rue Chabrol.

J'ai vu fonctionner le métier de M. Gilroy, et il m'a paru exempt de reproches.

C. Desports.
48 rue Hauteville.

Vu pour legalisation des signatures de MM. Cordir et Desports sus apposées.

Paris, le 22 Mars 1841.

Le Commissaire de police du Quartier du faubourg Poissonnière.

(L. S.) P. Arlam.

Je déclare avoir vu fonctionner le métier en question. Le but que se proposait son auteur me paraît parfaitement réussir. La substitution des eccentriques aux courbes à cœur évite les chocs, la différences des rayons donne en ouvrant les chaines le temps à la navette de passer un mécanisme ingénieux, tend le fil engagé d'approcher de l'ouvrage, et depense le battent de faire autant de chemin que l'ordinaire, de l'ensemble de les dispositions il en resulte un tissage rapid et exempt de défauts; j'atteste avec plaisir ce dont j'ai été temoins.

M. Le Baron Seguier.

Vu par nous, Maire du 11e Arrondissement de Paris, pour légalisation de la signature de M. le Baron Séguier, apposée au bas de la présente attestation.

Fait à Paris, le 23 Mars 1841.

(L. S.) Vaillant.

A. M. le rédacteur en chef du Commerce.

Paris, 24 avril 1841.

Monsieur,

Ayant lu dernièrement, dans un numéro supplémentaire de votre journal, sous la date du 31 mars dernier, un article relatif à un nouveau métier Jacquard, marchant à la vapeur, j'ai été fort surpris, et tout autre fabricant l'eût été à ma place, d'y trouver la déscription d'une prétendue découverte de MM. Malmazet aîné, Deplanque fils et compagnie pour laquelle il est dit que ces messieurs viennent de prendre un brevet qui porte la date du 4 avril 1840. Il est dit dans cet article qu'antérieurement à cette découverte "les Anglais avaient bien appliqué la vapeur aux métiers à tisser les étoffes unies, mais on n'avait pu encore parvenir à l'appliquer aux métiers à tisser les étoffes damassées à dessin; ce problême difficile et important vient d'être résolu par MM. Malmazet aîné, Deplanque fils et Ce du Lille (Nord.)"

Tout fabricant éclairé en France, en Angleterre, ou dans tout autre pays saura reconnaître l'inexactitude de ce qui précède et cela pour raisons suivantes:

1° MM. Malmazet aîné, Deplanque fils et Ce paraissent ignorer entièrement que *dix brevets* ont été pris en France depuis 1834, pour la fabrication des étoffes croisées, satin et façonnées, par les métiers Jacquard, marchant par la vapeur, lesquelles métiers marchent admirablement bien. Deux de ces brevets ont été pris au nom de MM. Pihet et Ce, avenue Parmentier, 3, à Paris. Les huit autres ont été pris au nom de M. Charles Cunningham, et l'invention est de M. C. G. Gilroy, ingénieur et fabricant. Le brevet de MM. Malmazet aîné, Deplanque fils et Ce est compris dans ceux de M. C. G. Gilroy. Le moyen surtout employé par ces messieurs pour faire marcher le métier n'est qu'un imitation de celui de M. Pihet et de M. Cunningham. Quant à ce qui a rapport aux autres parties de la construction

du métier, il n'y a rien de neuf en aucune manière ; et tous les fabricans sont prévenu par le présent article que toute contrefaçon de l'invention du sieur Gilroy sera poursuivie selon la loi.

2° Ce sont les métiers de l'invention de M. Gilroy, qui, les *premiers*, en *Angleterre* et *en France*, ont fait marcher les *métiers Jacquard* par la *vapeur*, pour cette fabrication. M. Gilroy a formé une société à Londres pour exploiter cette invention, avec un capital de 30,000 liv. st., et il a payé à MM. Poole et Carpmael, du bureau des brevets, à Old-Square, Lincoln's Inn, à Londres, depuis 1834, la somme de 1,500 liv. st.

3° M. Gilroy, qui a fait la découverte de toute ces inventions ingénieuses et utiles a employé huit années d'un travail assidu et depensé plus de liv. 6,000 pour arriver à ce but désirable, et aucun frais, aucun sacrifice n'ont été épargnés pour obtenir ce résultat. Les spécifications attesteront l'immense importance des résultats que doivent obtenir les fabricans par l'emploi de ces inventions.

4° La moindre vitesse des admirable métiers Jacquard par la vapeur ; de l'invention de M. Gilroy, n'est pas au dessous de 108 coups de navette par minute, et la vitesse ordinaire est de 115 coups, et sur les étoffes de gros de Naples façonnées de 18½ jusqu'à 25 pouces ; ils ont marché avec une rapidité de 125 à 137 coups de navette par minute, sans aucun dérangement dans la machine Jacquard.

Les fabricans et les ingénieurs dont les noms suivent attesteront la vérité de ce qui a été dit à l'égard des métiers de M. C. G. Gilroy :

MM. E. Feray, fabricant de damassées, filature de lin et construction de machines à Essonnè (Seine-et-Oise) ; Le Gentil, député du 3e arrondissement, rue Poissonière ; Henry aîne, fabricant, juge au tribunal de commerce ; Bosquillon, fabricant, arbître près le tribunal de commerce ; Ch. Dupuille, fabricant de soie, rue St-Augustin, 22 ; Desports, directeur de la société anonyme pour les filatures de lin, tissage, etc., Paris and Amiens ; Lehr, fabricant et banquier de la maison de Couchet, Rey, Le Bœuf, et Lehr, passage des Petites Ecuries, à Paris ; Dioudonnat, fabricant de machines Jacquart, rue St-Maur, 12 ; le baron Séguier, membre du comité de la Société d'encouragement pour l'industrie nationale ;

MM. les ingénieurs-mécaniciens, Henry Debergue et Spreafico, quai Jemmappes, 228, à Paris ; Sanford & Varrel, rue Rochechouart, à Paris ; E. Phillippe, rue Chateau-Landon (Faub.-St-Martin,) Paris.

Fabricans en Angleterre et en Irlande :

MM. L. et E. Wilson, neveux du dernier lord-maire de Londres, 124 Wood Street, Cheapside ; W. H. Wood, ingénieur et constructeur de machines à vapeur, etc. Renelagh Road, Thames Bank, London ; Michel Andrews, fabricant royal du linge damassé à Ardoyne, Belfast, Irlande ; M. Coulson, fabricant royal à Lisburn, Irlande ; W. Webb, chez MM. Jacquier et Ce, à Spitalfields, à Londres ; et John Dove, 4 Mape Street, Bethnal Green, Spitalfields.

Tous ces messieurs ont vu fonctionner les métiers de l'invention de M. C. G. Cilroy, et ils ont donné à l'excellence de ces métiers leur entière approbation.

W. W.

I have seen the looms at work in London and in Paris and have great pleasure in giving evidence to their excellence.

Henry Wood.

19 April, 1841.

We have seen Mr. Gilroy's machines working both silk and linen; and workmen of ours have superintended them here and in France, and we can speak of the inventions and the manner in which they work in the most favourable terms.

L. & E. Wilson.

Merchants and Silk Manufacturers, 124 Wood St. Cheapside, London.
March 11th, 1841.

From what I have seen of Mr. Gilroy's former inventions in machinery for weaving figured goods by power, I have every confidence that the present one, (alluding to Poole's patent of May 12th, 1839,) will in all respects meet the wants of manufacturers of silk and woollen textures, such as gros de Naples, vesting stuffs, &c.

Michael Andrews.
Damask Manufacturer, Ardoyne, Belfast.

January 10th, 1841.

Messrs. Editors:

A patent was obtained about a year since by Mr. C. G. Gilroy, now of New York, for improvements in the power loom for weaving figured goods of various kinds, either of silk, wool, linen or cotton, which looms are now in successful operation. The writer has seen specimens of the work executed upon them from each of these materials, some of them in a style which the manufacturers of Lyons would not be ashamed to own, and of a texture differing from every previous manufacture. Mr. Gilroy has spent a number of years in France, England, Belgium, and Prussia, in which countries he has obtained upwards of thirty patents for various improvements in the manufacture of textile substances; and he has in his possession the highest testimonials from the first manufacturers of France, and from others eminent in judgment and station, showing the estimation in which his improvements are held in that land of art and taste. Mr. G. has recently deposited in the Patent Office another model, exhibiting various new improvements in the loom, and which is intended for the weaving of table-cloths, shawls, piano-forte-covers, window curtains, and other

articles of a similar character. By the action of this loom the business of weaving will be much facilitated, as by its means he will be enabled to work at the rate of from eighty to a hundred and thirty picks per minute, and to produce perfect goods in patterns of great complexity.

T. P. JONES.

Daily National Intelligencer, Washington, D. C., April 6, 1843.

Patent Office, March 10, 1842.

Sir :—

A very numerous collection of specimens of your silk weaving have been received for exhibition in the "National Gallery of Manufactures and Agriculture," also a sample of carpet weaving. Their extreme richness and brilliancy, entitle them to great praise, and will afford me much gratification in the display.

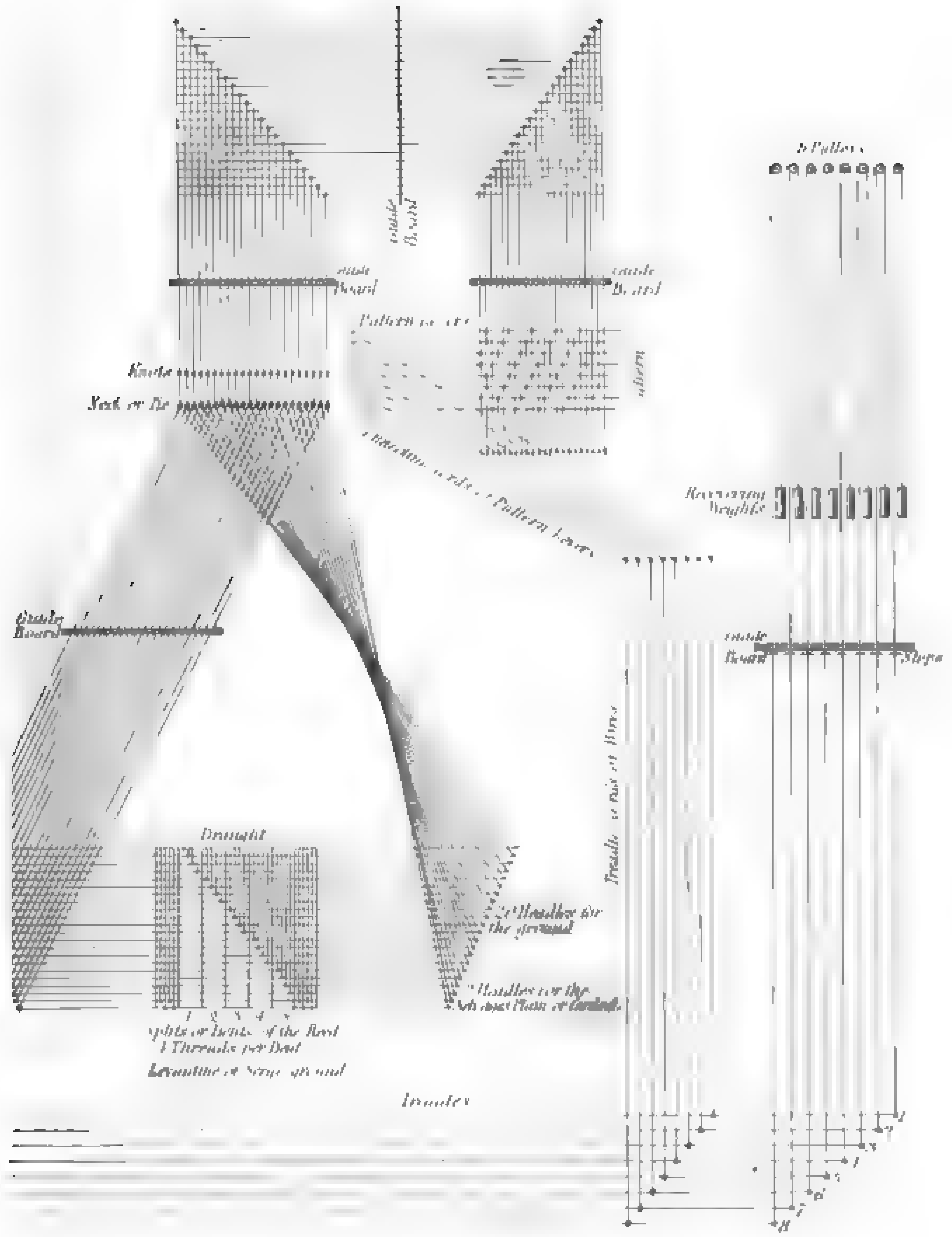
Respectfully Yours,
H. L. ELLSWORTH,
Commissioner of Patents, Washington.

Mr. C. G. Gilroy,

WOOL MOSAIC CLOTH.—A new invention has recently been introduced into London from Berlin, and, as we learn, is soon to be introduced into our American cities, in which the brilliancy and variety of colours of Berlin wool are blended together in devices of surpassing elegance and richness. The manufacture has all the appearance of painted velvet, with the texture and lasting qualities of a woven fabric. In the process of manufacture the figures, with their various hues, are woven in a thick pile several inches long, and the fabric is then divided into laminæ and fixed on to flexible India rubber ground work, each slice of the pile producing a separate picture in wool. Some of the groups of flowers produced by this process are exquisitely beautiful, and are admirably adapted for the decoration of palatial drawing-rooms. The attempts to copy paintings and to take likenesses are comparative failures, but for ornamental designs the mosaic cloth is almost unrivalled in beauty.—[Boston Transcript.

This invention is described at page 249, to which the reader is referred.

Example N°1

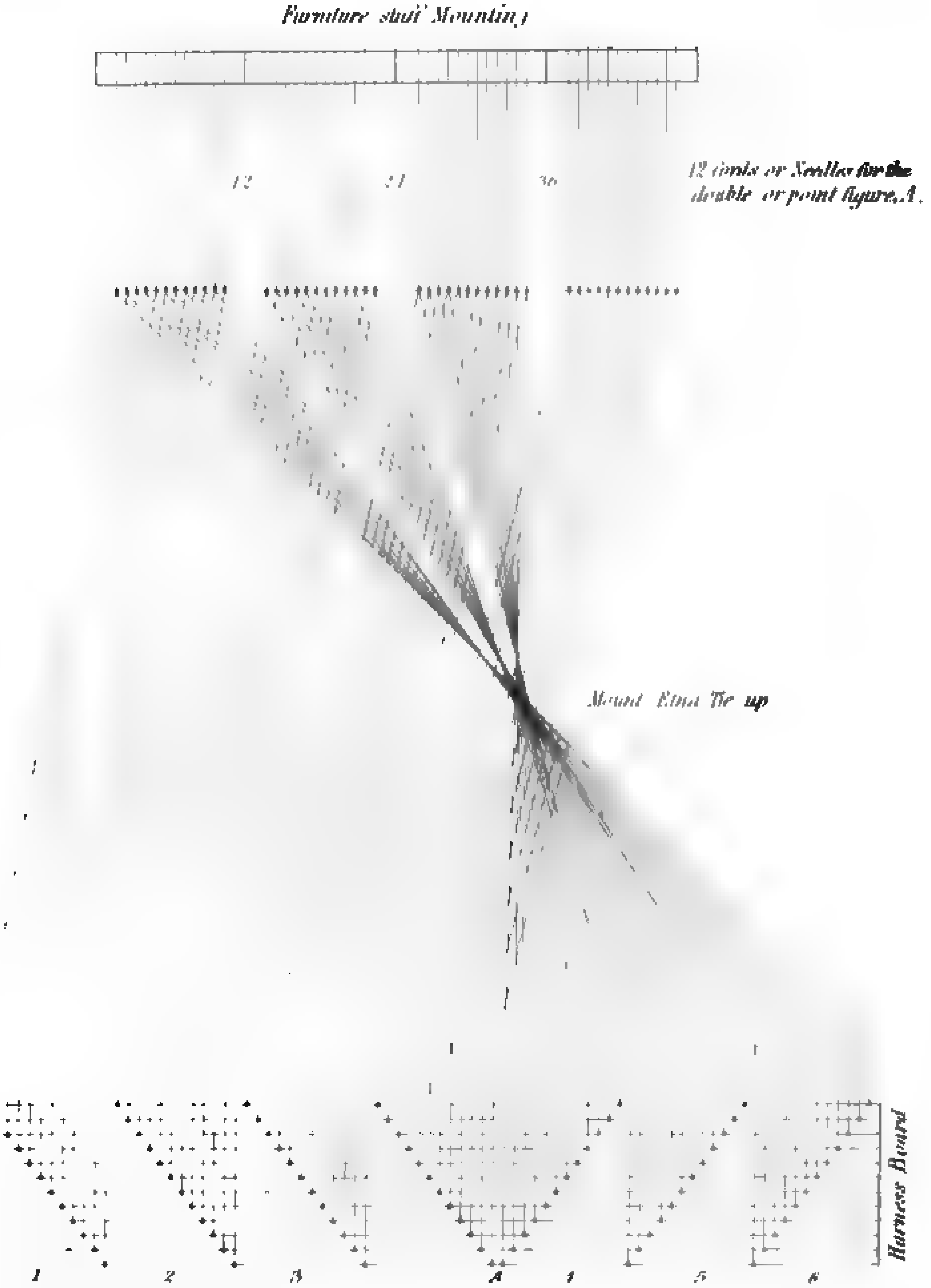

Knots
Neck or Tie
Guide Board
Draught
Treadles
Reversing Weights
Stops

Example No. 2

Furniture stuff Mounting

In the Example No. 2 figures 1,2,3,4,5,6, indicate regular repeats or running patterns and that marked A a point pattern. When a double or point pattern is made in the middle of the web, (as in this example) it is called a bastard or illegitimate design. All bastard goods are used for covering sofas.

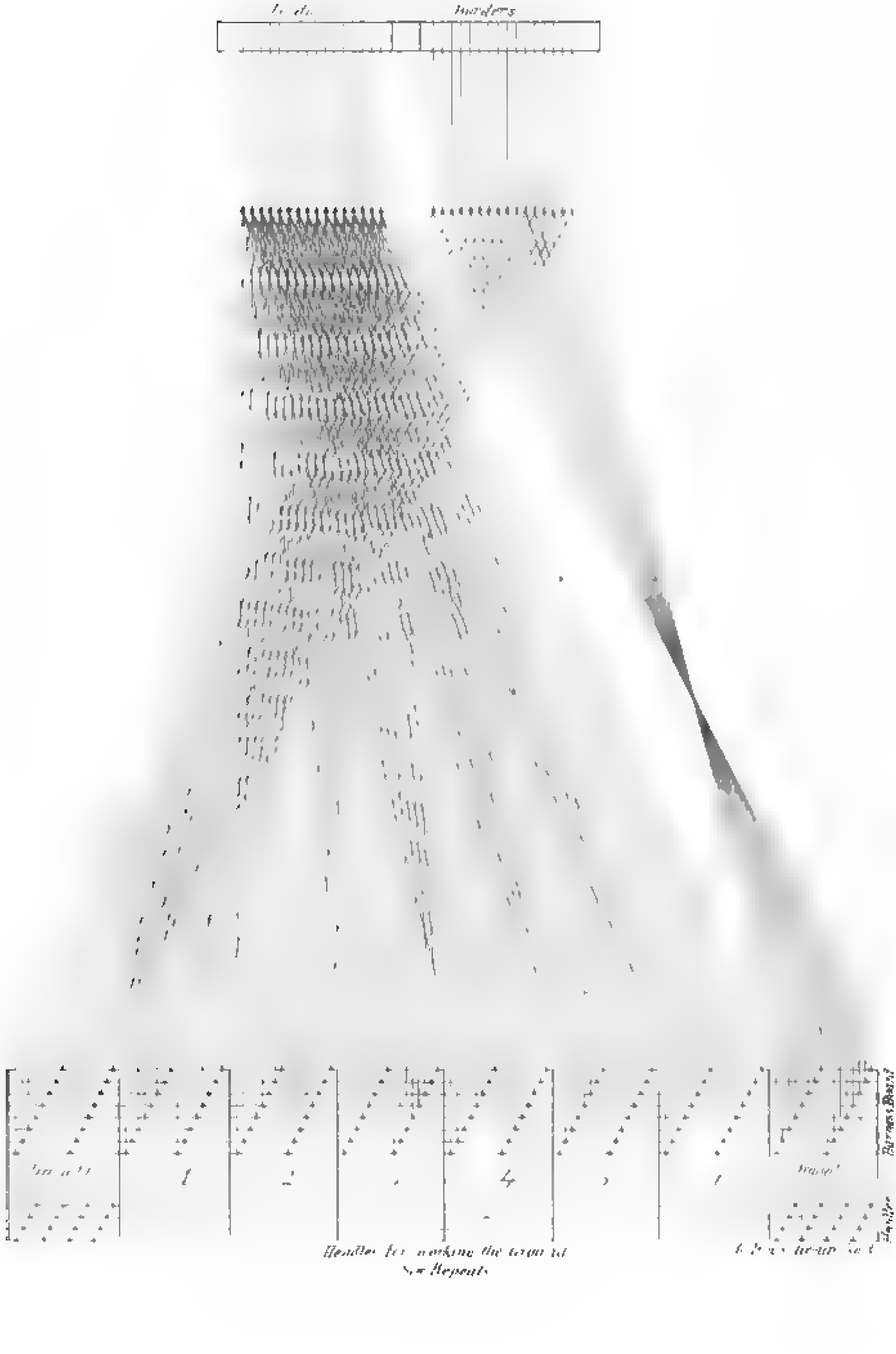
Example No. 2



the Example No. 2 figures 1 2 3, 4, 5, 6, indicate regular repeats or running patterns and that rked A a point pattern When a double or point pattern is made in the middle of the b. (as in this example) it is called a bastard or illegitimate design All bastard goods used for covering sofas

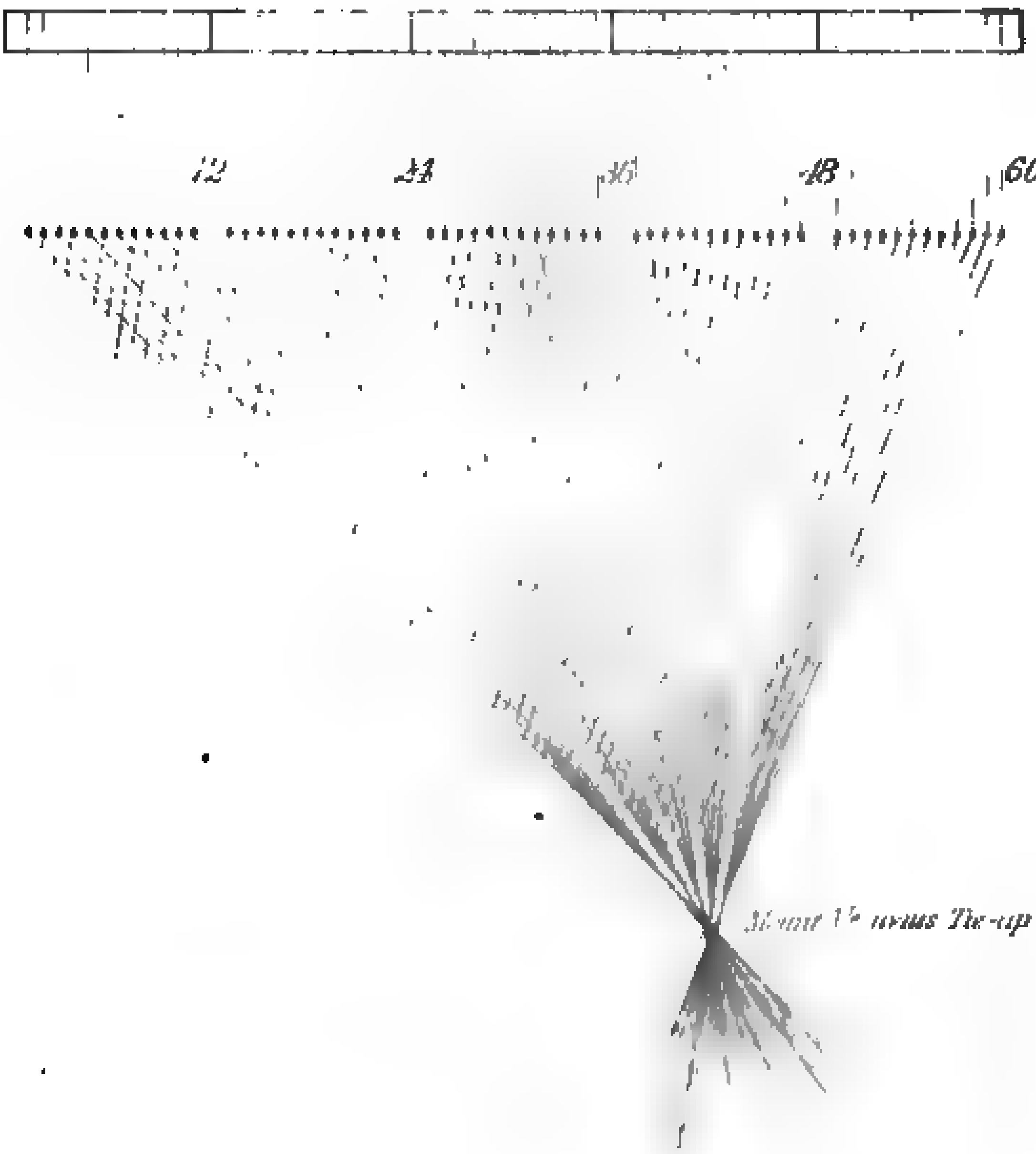
Example No. 3

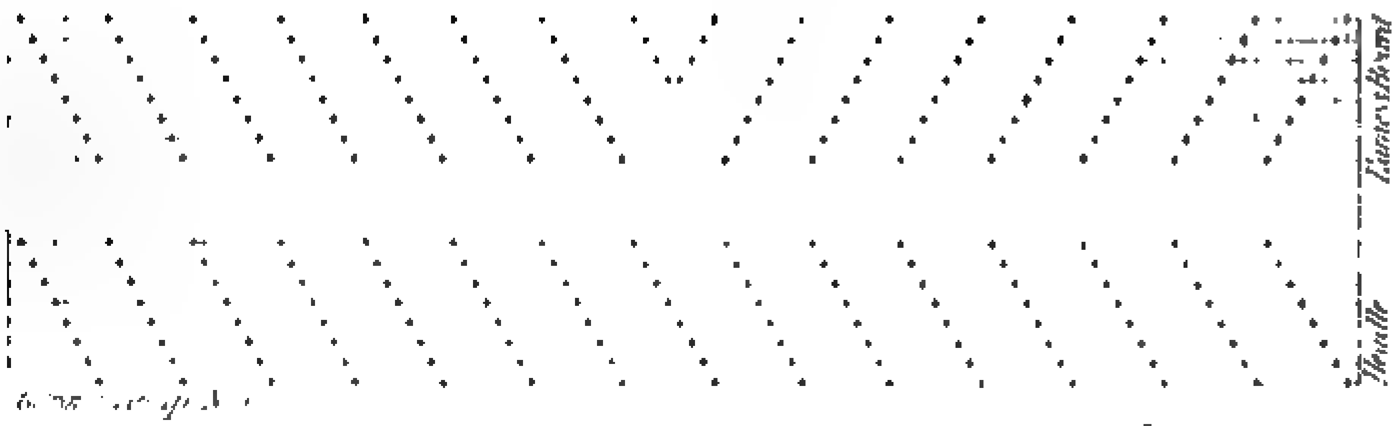
Harness ... Mounting
with either one or two Jacquards



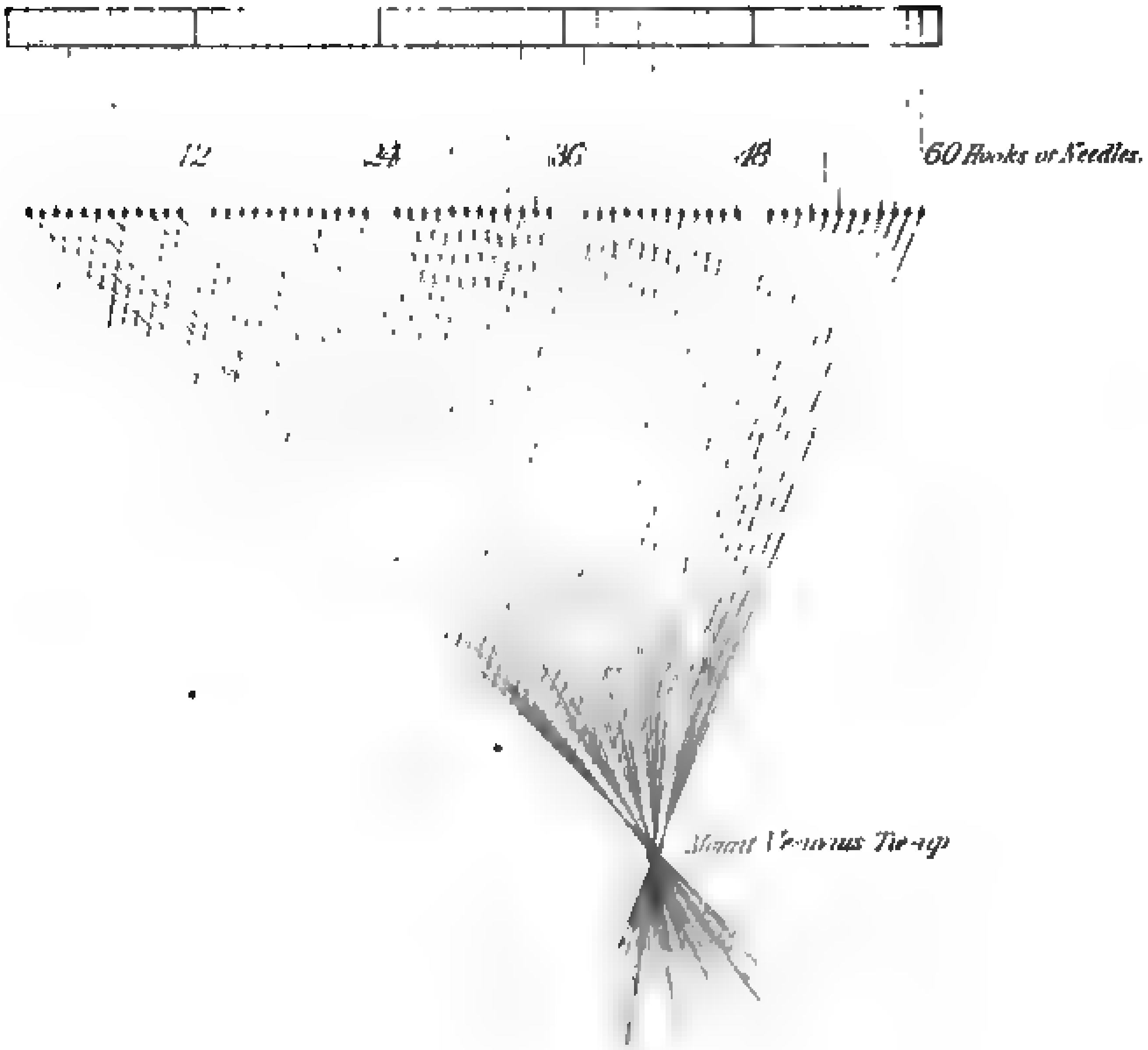
Healds for working the ground of
Six Repeats

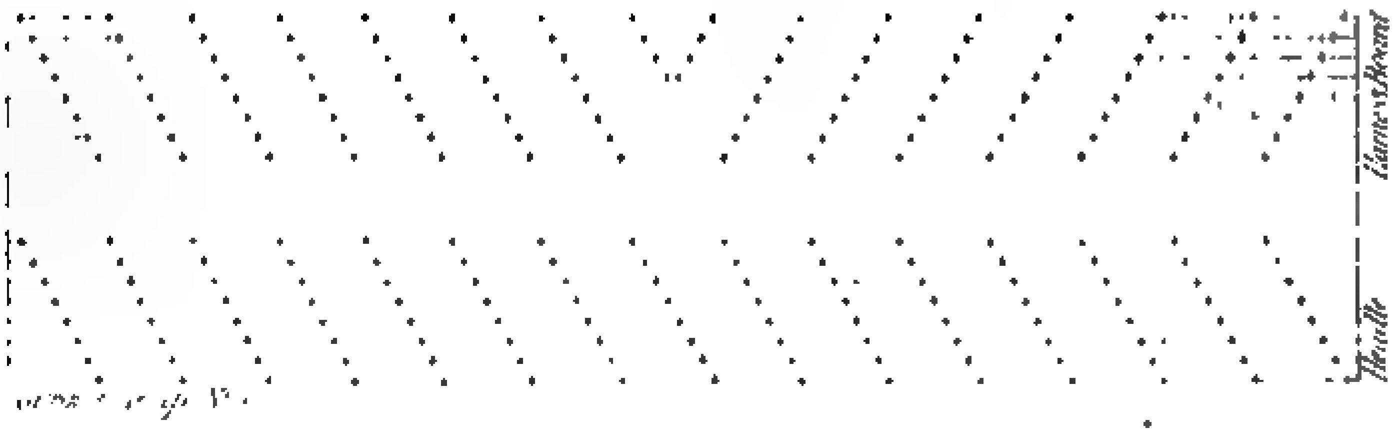
Example Nº 5



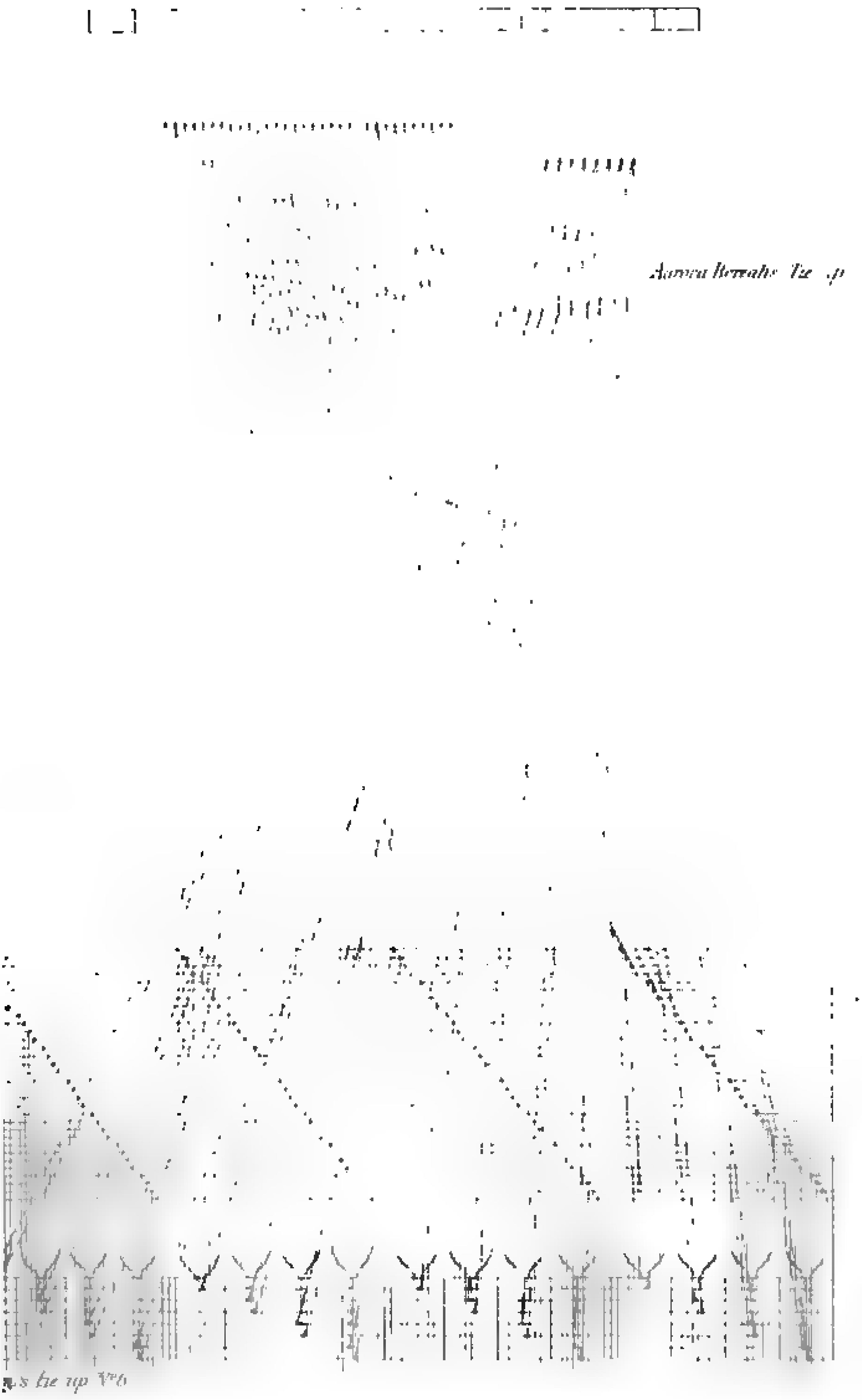


Example No. 5





Example No. 6.



Example No 7

Plush Velvet (light)

(2 Threads per Dent)

With from 1 to 6 Jacquard Machines

No 1 Harness Board for the Body No 2 Heddles for the Ground No 3 Heddles for the Pile

ings Tie up

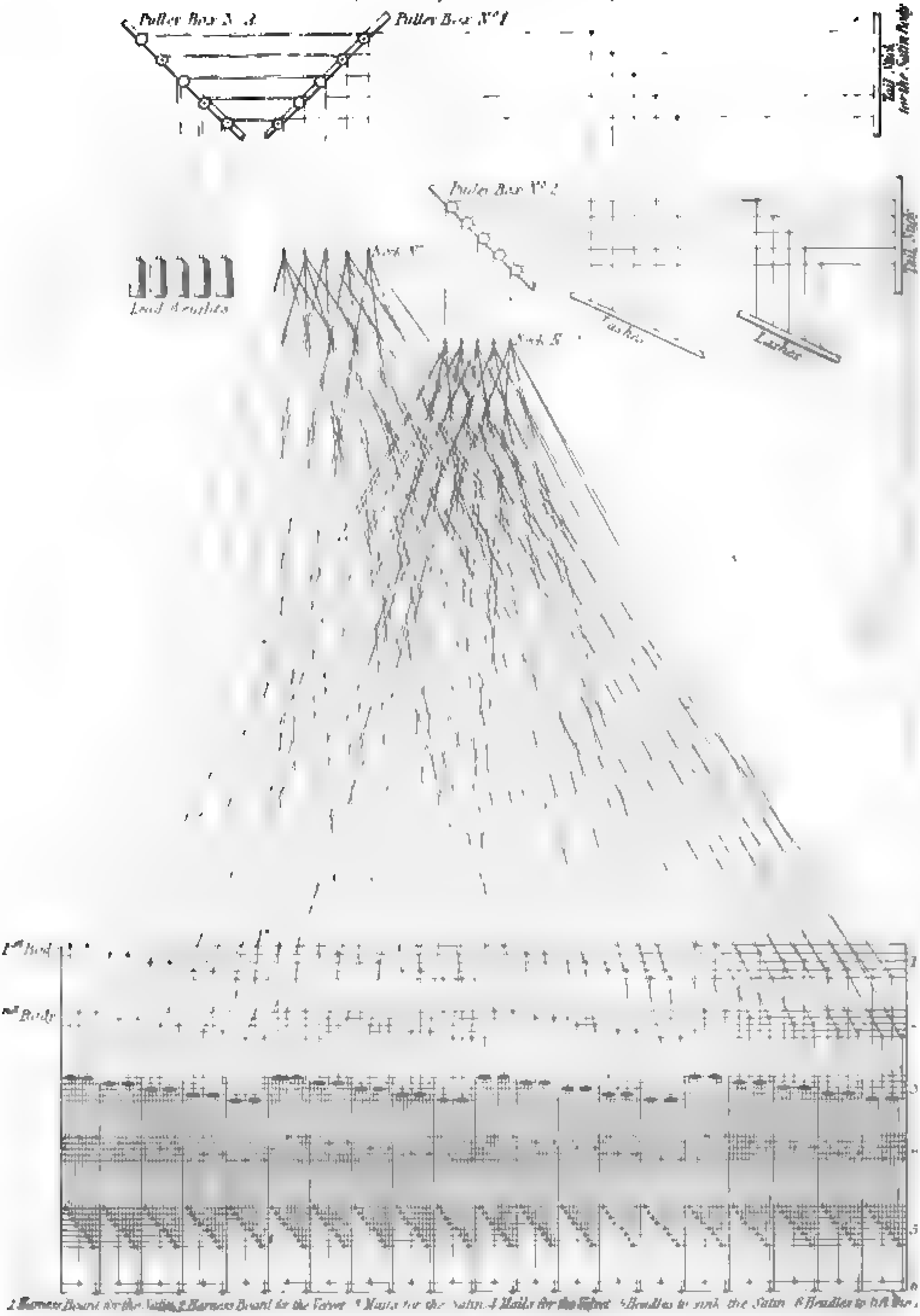
Example N.° 9

Draw Loom

Velvet Mounting with Satin Ground.

Called by the French Velour Gandin; or Gandin Velvet

(4 Threads per Mail, and 4 Threads per Dent.)

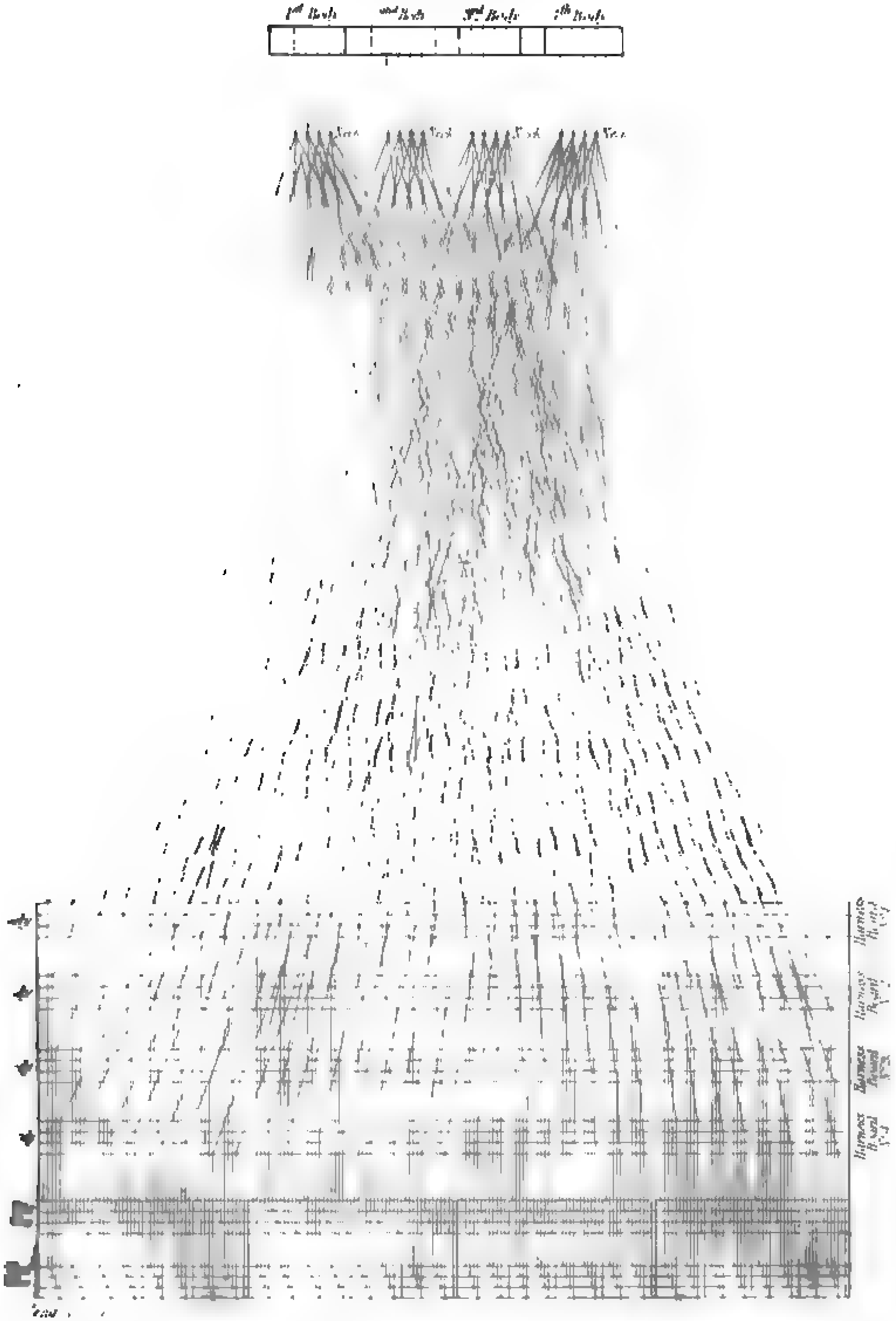


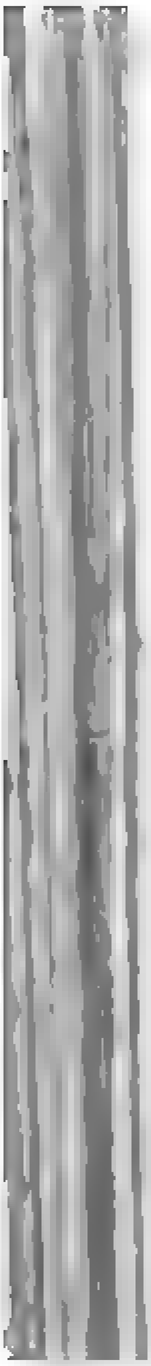
1 Harness Board for the Satin, 2 Harness Board for the Velvet, 3 Mails for the Satin, 4 Mails for the Velvet, 5 Heddles to sink the Satin, 6 Heddles to lift the ...

Example No. 10.

Velvet Mounting

With either 1 or 4 Jacquard Machines





INDEX.

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